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The Tin Position

WHILE these words are being written the International Tin Council is meeting in London, and before these same words appear in print it may well be that the decision of the Council in regard to the present position of tin will be announced. In any case, until the decision of the Council is known the market will undoubtedly proceed with caution. A particular point of interest at the moment, however, is that the cash price of tin, at around £750 per ton, is the highest for over a year. The present conditions are in sharp contrast to those which prevailed a month or two ago, when prices broke sharply because of the withdrawal of Buffer Pool support and plummeted by nearly £100 a ton from the then Pool floor of £730. The fact that the market has made such a spectacular recovery undoubtedly testifies to the fact that it is shaping up extremely well without any Pool support. In a large measure, this reflects the drastic curtailment of exports which the I.T.C. has had to make.

For the final quarter of this year the total permissible exports for the six signatory producers is 20,000 tons; in the third quarter the rate was 23,000 tons. The present rate represents an overall reduction in exports of 48 per cent. Moreover, at long last, it would appear that the pipeline is virtually empty and that the drastic cutback is making itself felt. Recent trade estimates put the deficit of world production of tin in relation to consumption at about 25,000 tons. This deficit is higher than earlier estimates because of the reduced selling pressure from Russia to China. Total sales of Russian tin this year are expected to reach between 15,000 and 16,000 tons; next year it is thought that Russian sales are unlikely to exceed 12,000 tons.

Statistical considerations, together with prospects of an improved demand from the U.S.A., should go a long way in maintaining, and possibly increasing, the price of the metal. Because of this, some trade quarters do not expect the I.T.C. to disturb the existing arrangements, especially since the market has only recently emerged from a crisis. One of the big imponderables, however, is the I.T.C. policy in regard to the tin bought with the Special Fund, amounting to between 4,000 and 5,000 tons. The sale of this tin is not governed by the conditions attaching to the tin acquired with the compulsory contribution. Metal bought on the latter basis is saleable when the cash price reaches £781 per ton, whereas the Special Fund tin is disposable at any time. If any Special Fund tin is sold, it will presumably be in the way least harmful to the market. Some trade quarters have hinted that the I.T.C. might decide to apply the £781 price to Special Fund tin only for the time being, to give additional confidence to the market. On the question of Russian participation in the International Tin Agreement, it is considered rather unlikely at this stage that she will join as a full producer member.

As Vivian, Younger and Bond say in the review of the market for last month, the struggling course of the metal in the first ten months of this year ran counter to many, if not most, hopes that restriction of output would effectively match the lower demand. In 1959, however, it does look as if the main pre-occupations in the tin industry will be the extent to, and the price at, which the Buffer Stock manager can lighten his holding and, last but not least, how much the present very burdensome curtailment of output can be alleviated.

Out of the MELTING POT

Mixing

IN the field of organic finishes, more consideration might well be given to what metals, entering it in the form of powders, could do for finishes. What, unfortunately, still happens too often is that, once in the field, such metal powders become mere adjectives. Paint containing aluminium powder, for example, whatever its virtues undoubtedly are, is still aluminium *paint*, and still awaits further developments to a stage where its characteristics would justify its being referred to as paint aluminium, a term the present strangeness of which is indicative of the distance still to be covered. Elsewhere, metals entering non-metallic fields in small amounts in the form of coatings might well be followed more closely. Not all the processes concerned with the metal coating of non-metals are as old-established or as familiar to metal finishing as, for example, the chemical silvering of glass in the manufacture of mirrors, or metal spraying in the metallizing of all sorts of non-metallic materials. Thus, metal finishing might spare a thought to the possibilities in its own field of the various modifications of the firing process used to metallize ceramics, and, perhaps, two thoughts to the reason why vacuum coating is not as widely used in metal finishing as it undoubtedly could be. Nor need these excursions into neighbouring fields take place in one direction only. Plastics-coated metal sheet should be an adequate example of benefits to be expected from a broad- and open-minded attitude of hospitality towards outsiders. Finally, the fact that the few examples of neighbourly interest and co-operation that have been mentioned above can be topped by many more should not be used as an excuse for complacency, but rather regarded as evidence of the valuable possibilities still to be developed.

For the Record

JUDGING from past experience of the way in which the findings of laboratory experiments are put into practice, one may expect, in not less than five years' time, to read an announcement of the remarkable results achieved by the hydraulic extrusion process. In five years' time it will naturally be a little difficult to remember the fact that the hydraulic extrusion process was by no means new even in 1958. Returning to the present it is, therefore, worth noting that hydraulic extrusion of metals was suggested by Bridgeman some years ago and that, more recently, the results of laboratory investigations of the process have been published by the Laboratory of the Academy of Sciences of the U.S.S.R. devoted to the physics of extremely high pressures. To begin with, it is perhaps necessary to explain that, in hydraulic extrusion, the extrusion pressure is applied to the extrusion billet directly through the pressure fluid, instead of by a ram operated by hydraulic pressure as in a conventional extrusion press. In the container of a hydraulic extrusion press, there is a clearance between the wall of the container and the billet. Pressure fluid is admitted to the container, and pressure is exerted thereby directly on the billet. The front end of the latter is shaped to fit into the die opening to prevent the escape of the pressure fluid at the start of the operation, and the rear end of the billet carries a plug which is designed to close the die for the same purpose after the final portion of the billet has been extruded. Observations hitherto made on the hydraulic extrusion process include the following. As in ordinary extrusion, there is an optimum die entry angle which is smaller than in the ordinary extrusion process. The extrusion pressure required for a given extrusion ratio is much lower in hydraulic extrusion because of the reduced friction losses in the container and the die. In the latter, a thin film of the pressure fluid is present between the die surface and the surface of the metal being extruded: the cross-section of the extrusion is slightly smaller than the cross-section of the die, and scratches, etc., on the surface of the billet reappear in a correspondingly elongated form on the surface of the extrusion. The nature of the fluid has a marked effect on the magnitude of the extrusion pressure and on the surface finish of the extruded section. Some liquids (e.g. hypoid lubricant) may even cause the breaking-up of the section into separate fragments. The surface finish is better the less the viscosity of the fluid used increases with pressure. The best results were obtained by using water but giving the billet a coating of hypoid lubricant. Coating of the billet with tin-lead solder was also effective.

While Waiting

FOIL metallurgy was suggested some time ago (this page, METAL INDUSTRY, 10 January 1958, p. 22). As is invariably the case on such occasions, there has since been no sign that anybody has taken the slightest notice of this gratuitous suggestion, let alone that anybody intends doing something about it. On the other hand, the fact that no one has written to say that foil metallurgy is by no means new or that the method has been in use for the past ten years or so, does suggest that the proposal is, in fact, new. It may be recalled that, as suggested, the process of foil metallurgy involves the forming of parts from metal foil by crumpling, pressing, or other suitable means, and the subsequent sintering of such foil compacts. A variant of the suggestion envisaged the use of an adhesive as a bonding agent for the compacted foil. Numerous other variations of the basic process of foil metallurgy will, of course, suggest themselves to those skilled in the art. While waiting for the latter to apply themselves to the task of developing foil metallurgy, it is of interest to note that an approximation to foil metallurgy has been claimed in a recent patent specification relating to the production of structural shapes from metal foils. According to this invention, several strips of foil of the same metal, or of dissimilar metals, are coated with an adhesive (a liquid thermosetting epoxy resin adhesive) and are then wound in overlapping relation upon a mandrel to form a tube. The interior of this tube is likewise coated with adhesive, and the tube is collapsed by compression to form a "solid" T, L, H, or other section, which is then cured to set the adhesive. Advantages claimed for structural shapes produced in this way include the ease of manufacturing such shapes as compared with conventional metal working methods, greater strength of the sections as compared with that of corresponding solid metal sections, the reduced metal content of such sections (which may be as low as 60 per cent), and advantages arising from the possibility of using foils of different metals in making a section.

Skimmer

EXPLOSION DANGERS — DUST FIRES — OTHER HAZARDS

Health Hazards in Metal Spraying

By W. E. BALLARD, F.R.I.C., F.I.M.

Metallic dust constitutes a potential danger to the health of workers in many industries and much of the information in this Paper, which was given at the Second International Metal Spraying Conference, applies equally to those other industries where such dusts are encountered.

DURING the past two decades, a good deal of literature has been published on various aspects of the metal spraying process, and it is unfortunate that much of it appears to be repetition. One aspect of the industry which seems to have received little attention from writers appears to be the hazards to the operator. With the extension of metal spraying to the treatment of large structures, operators must face the ordinary risks of structural engineering which, for example, may include:—

(1) Accidents due to bad handling, the slipping of loads and collapse of piles of material. These usually result in broken limbs and severe lacerations.

(2) Falls from structures when working on site, resulting in broken limbs, ribs and head injuries.

(3) Burns due to carelessness with lighting devices.

(4) Minor cuts and bruises.

The incidence of such accidents, common to most industrial endeavour, can be lessened by good management, exhibition of posters, attention to floor levels, etc.

There are, in addition to these occurrences, other hazards which, if not peculiar to metal spraying, are more likely in that process than in many others. They are:—(a) Fire and explosions of gas. (b) Dust fires. (c) Poisoning and respiratory troubles due to dust. (d) Dermatitis.

On entering a metal spraying establishment for the first time it might appear that these risks are considerable, but in actual fact the record of the industry in most countries appears to be good, and with some increase of knowledge and attention to detail, most risks would virtually disappear.

It is a truism to say that when industrial accidents occur they are due to a combination of unusual circumstances. For example, a gas leak may not in itself be dangerous if there be no naked light in the vicinity, but if the escaping gas is composed largely of hydrocarbons and there is also an escape from an oxygen line from a nearby pipe, and an electric fuse blows sufficiently near, a terrible explosion could result. Another example can be cited. One man among many may suddenly develop dermatitis through some slight change in his metabolism.

Fire and Gas Explosions

The majority of manually-operated pistols used in the world to-day are gas-operated, and are fed with three pipe lines carrying compressed gases, air, oxygen, and a fuel. The gases are led into the tool through rubber pipes, the walls of which are reinforced with one or two layers of fibre. These tubes in themselves give little trouble, provided they are inspected daily and replaced as necessary. Examination of these pipes is particularly important when work is being carried out in confined spaces or in elevated positions. The movement of the pipes over sharp edges of manholes is liable to cause chafing. Also, the tube walls can be damaged by dragging work over the lengths laid on the floor. The practice of repairing such tubes with adhesive tape should be discouraged. It is advisable to have the gas tubes of different colour, usually red for the combustible one and black for oxygen. The permanent service pipes round the works should be painted with identification colours. There is a standard scheme in most countries.

Where joints have to be made, the rubber pipes should be firmly wired to the metal connectors.

Until about twenty years ago, it was common practice to design spraying pistols with a single plug valve which controlled all three feeds. If the valve was not carefully ground in and maintained in that condition, it was possible to get a seepage of gas between any two of the passages, and at least two explosions occurred in Great Britain due to this happening when the pistol had been shut off but the operator had omitted to turn off the fuel gas and oxygen supply. Because of this difficulty, the single plug valve was replaced by three separate plugs connected to a common control lever. More recently these have been replaced by diaphragm valves, which make it almost impossible to get gases forcing their way into the wrong channel. Before the plug valve was abandoned, in some makes of tool a groove was cut in the plug between each pair of gas ports, and the groove had free access to the atmosphere. This was not satisfactory, the provision of the groove reducing the area of the valve seating. It is somewhat surprising that American practice still seems to favour the plug valve.

It must be admitted that there is a tendency for wire metal spraying pistols to backfire from the nozzle, this being largely due to heat conduction back down the wire itself. Such occasional backfires seldom lead to anything more serious than a burned nozzle. In some types of pistol where the design necessitates the use of critical gas pressure, safety devices in the form of jets or porous plates are incorporated at the back of the nozzle to prevent flash back to the tubes. Such methods are not usually necessary and, in fact, lead to unnecessary complications.

In these days, the use of compressed gas in cylinders is so common that operators are used to the handling of them.

Oxygen cylinders contain the gas at high pressure and should not be used as rollers. The cylinders are very safe as long as they are not allowed to leak in the presence of combustible materials such as oil or greasy rag.

Acetylene cylinders contain a porous material saturated with acetone, which acts as a solvent for the gas, which is explosive when compressed in space. The gas should not, therefore, be allowed to flow from the cylinder at excessive rate, otherwise the acetone will vaporize and escape with it. Leaks of acetylene are easily detected by smell. The gas should not be transported in copper tubes, as it can combine with copper, forming cuprous acetylide, a black detonatable material.

Propane is not very odiferous in itself and escapes are not always detectable, although a stenching agent is normally added. The cylinders contain the hydrocarbon in liquid form and the pressure is 145 lb/in^2 at 15·5°C. Should the cylinders show frost on the outside to the depth of the liquid inside, the gas is being withdrawn too rapidly, and a leak can be suspected. The cylinder walls are comparatively thin, and rusty-looking cylinders must be suspect, especially when the rust is around the skirt.

Automatic apparatus often has a multiplicity of nozzles, and these may be built into a confined space. If, during shut-down periods, the exhaust fan is off and the fuel gases are not shut off, slow seepage may occur, and the nozzle chamber may contain an explosive mixture. Designers of such plant should take account of such eventualities. The switching on of the exhaust fan should be arranged to occur automatically some moments before the striking of the lighting device. Plants should not be installed in pits or confined spaces.

If coal gas from town mains is used, it is compressed and piped round the shop. The gas enters the works through a master valve placed before the meter. This valve should be regarded only as a last means of checking flow, and should never be closed except at times of extreme

emergency. If the compressor is started up with this valve closed, there is a danger that the meter will collapse—an event not welcomed by the gas utility undertaking. From the meter the gas flows through a non-return valve to a receiver, which must be adequate in size to prevent the pulsation of the compressor affecting the meter. The pressure in this receiver is never at more than a few centimetres differential pressure compared with the ambient atmosphere.

No connections to any other apparatus must be allowed between meter and compressor. In past years, branch pipes to gas rings at this point were sometimes encountered. It is possible for the compressor to draw in air. An explosion in such a gas plant some years ago was most likely caused in this way.

From the receiver the gas passes to the compressor, and from it through another non-return valve to the high pressure receiver. This is followed by a further non-return valve, and then the gas passes to the factory main. It should be realized that compressed town gas contains hydrocarbons, which attack all forms of natural rubber and some of the synthetics; the choice of gasket material is, therefore, very limited. Neoprene seems to be most satisfactory.

The gas from the relief valve of the compressor is piped back to the low pressure receiver. The multiplicity of non-return valves is an essential feature of these installations, and is usually insisted upon by the gas suppliers.

The existence of ample supplies of compressed fuel gas in a works constitutes a risk to the careless workman who, unless well supervised, is apt to connect blow pipes and burners indiscriminately for various purposes. It is possible to leave the points turned on without lighting them. This behaviour has led to explosions.

Dust Fires

Most metal spraying shops have accumulations of dust around their premises, most frequently aluminium, zinc, and possibly dusts of iron from reclamation work and from the steel grit used in blasting. In the United Kingdom, the use of sand or silica grit for blasting is not permitted, and, therefore, there is no trouble with silica dust around the premises. There may be a certain amount of dust from fused bauxite, which is sometimes used for blasting in place of steel grit, but such material, incombustible in itself, would tend to suppress fire. As a result of blasting with iron or steel grit, there is a likelihood of heavily oxidized iron dust lying about the shop. If this type of dust is mixed with aluminium from the spraying process a "Thermit" mixture results which could fire under certain conditions.

The hazards of dust from the point of view of fire might be considered under three headings. First, the dust which accumulates on beams and roof trusses. This may contain metal dusts, chiefly aluminium and zinc, as well as iron oxide from reclamation or blasting. A fire was experienced from this material lying on roof trusses at the author's works in Dudley, and this led to experiments on the possibility of ignition. It is surprising that it is difficult to ignite such mixtures. The heat from an ordinary fire, a smouldering cigarette end, or even a Bunsen flame, does not raise the temperature sufficiently to ignite this type of dust when it is lying undisturbed. An electric short from a badly insulated cable, or a very hot globule from pistols spraying iron, may start a fire with such material. The temperature of ignition appears to exceed 1,000°C., and the dust is most dangerous if it contains about 75 per cent of iron oxide. If such a fire starts, it spreads comparatively slowly but it is almost impossible to put it out by any ordinary means. Any attempt by local fire brigades to extinguish such fires with water or foam is likely to end in an explosion, owing to rapid generation of hydrogen. Usually such dust fires originate in places difficult of access, and smothering by sand or other inert material is not usually practicable. The only practicable method of stopping such a fire once started, seems to be to make a fire break.

For this purpose, remove accumulations of dust from around the vicinity as quickly and as carefully as possible, so that it does not form explosive clouds, and remove everything combustible from around the fire area. In no circumstances should the smouldering dust be disturbed. The temperature which is attained by the material when it has caught fire is extremely high, and the reaction may give rise to sufficient heat to melt steel roof frames and asbestos sheet. Preventive measures which should be taken include keeping the amount of accumulated dust down to a minimum by removing it periodically with vacuum cleaners. The dust so removed should be taken away from any buildings. It is assumed that floors and places that are easily reached are cleaned periodically and, therefore, there is no danger of fire in such places. Naturally, a mixture of aluminium and iron oxide is the most dangerous, but fires with zinc dust and iron oxide, although infrequent, are not impossible, and the same remarks apply. Fire-fighting measures in such cases are more difficult owing to the generation of volatile zinc fume.

Smart[1] states that aluminium dust fires are much more likely to occur in conditions of maximum humidity. The danger of dust fires is increased where powder pistols are used in place of wire pistols.

The second type of dust fire, which is extremely dangerous, is that which might occur in the trunking of ventilating systems and in cyclone separators. Even very fine metallic dust is heavy compared with a gaseous vehicle, and it is almost impossible to avoid settling in ventilating apparatus, even when a high velocity is maintained. There are bound to be accumulations of dust, especially at bends, and fire doors should be installed at bends in trunking systems. Normally, separate ducts are used for metal spraying ventilation and that of the blasting rooms. Aluminium and zinc dust in such systems are not usually mixed with iron oxide and are, therefore, not so easily ignited.

In addition to the dust lying in the trunk, there is a small amount of material in very fine form which is in circulation in the air itself, bringing into consideration the third type of dust hazard, i.e. an explosive mixture of air and metallic dust. If an explosion of metal dust does occur, then naturally the dust that is on the sides of the trunking is blown into a cloud, and ignition may occur. A series of explosions and fires might be initiated. There have been one or two explosions in trunking which have been attributed to metal dust but, in the writer's opinion, this has not been proved; a metal dust explosion gives high temperature, and there had not been any evidence of this after the collapse of the trunking. The explosions are more likely to have been due to gas.

In general, it can be stated that the finer the dust, the greater the risk of explosion, but it must be remembered that most of the scientific data which have been collected in connection with dust fires of aluminium and zinc, have been based on experiments and experience with milled powders used in the paint industry. They certainly are more dangerous than those produced by spraying.

Nevertheless, in a pamphlet[2], both aluminium and zinc are classified as among those which ignite and propagate flame readily, the source of heat required being small.

Hartman, Nagg and Brown[3] have shown that particle size has an important relation to explodibility of metal dusts.

Minus 200 mesh size per cent (74μ)	Minimum explosion concentration oz/ft^3 or gm/L
1	0·125
15	0·060
40	0·040
92	0·025

The majority of the powder obtained by metal spraying is less than 100μ and is irregular in shape, but there is very little below 75μ. The author's experiments have shown that it is extremely difficult to ignite sprayed aluminium at a concentration below 0·1 gm/L (0·1 oz/ft^3), and zinc requires twice this concentration.

From published literature it appears that a top limit of inflammability is reached at 0·32 gm/L of aluminium, but as this means 1 lb. of dust in 50 ft^3 of air, self suppression of explosions is not likely in commercial ducting.

The author's experience indicates that the source of heat to start a dust explosion must be much more intense than that used in Brown's experiments.

Hartman states that powders of magnesium, cadmium, copper, iron, manganese, titanium, antimony, zirconium, ferromanganese, and even tin and lead, can produce explosive concentrations in air. Presumably most of these metals would need to be much finer than anything produced in spraying.

There must always be a risk where there is a likelihood of dust settling, and it is, therefore, good practice to make the top of cyclone separators of very thin metal sheet or of rubber, or to install explosion flaps at the top. In the case of an explosion, the flame will go upwards into the open air and will not damage the cyclone itself, but will merely break the thin material at the top. So far as is known, although this risk must be assumed to be present, there has been no case of a cyclone explosion connected with a metal spraying shop. Nevertheless, the Factory Regulations in this country make it important to take into consideration all the factors that may arise.

It is often suggested that the dust from metal spraying may be separated by using water curtains, or by blowing dust-laden air down on to the surface of water. If the material is aluminium or zinc, it must be realized that this metal will re-act with water, giving off hydrogen, and unless there is a very good draught of air, it is possible to get an explosive mixture of hydrogen and air, which represents a much more real hazard than a dust explosion. It is for this reason that the author prefers not to use systems which depend on water. There is another difficulty in that such systems produce a sludge, the disposal of which represents a real problem.

Other Hazards

Having considered dust as a danger to the plant and buildings, it is desirable to give attention to its effect on the health of the worker. It is convenient to consider the problem under three headings, viz.: (1) The effects of dust inhalation on respiration. (2) The toxicity of certain dusts. (3) Dust as a cause of skin troubles.

If a dust particle is over 15μ in diameter, it is likely to be caught in the extremely efficient filter in the nose or the back of the throat, and a collection of such particles may be ejected by spitting. Fine particles are likely to be caught by whiplike appendages (cilia) which line the walls of the trachea and bronchial tubes in myriads. Such particles are likely to be carried upwards and outwards by the mucus. The spongelike structure of the lungs consists of millions of tiny cells with closed ends, called alveoli, and very fine foreign particles entering them cannot be ejected as there is within them neither mucus nor cilia. The air velocity in them is very small. Within the alveoli are much smaller cells, known as phagocytes which ingest foreign bodies, and carry them through the walls of the alveoli into the lymphatic system. When considering the effect of dust on the lungs, it is very important to remember that it is not the gross particles which are damaging, especially as they are trapped by respirators and the natural filters in the nose and throat. It is the particles from 1 to 5μ diameter which remain suspended in the air of the shop after respirators and helmets have been removed, unless ventilation is very effective, that are damaging. The pulmonary manifestations of dust inhalations are classed by the International Labour Office[4] under the general term pneumoconiosis.

A special form of pneumoconiosis is silicosis. For some reason not yet fully understood, free silica (SiO_2) produces the most serious form of dust disease. It is extremely irritating to the pulmonary tissues, which respond by fibrosis with the resulting formation of nodules. These often coalesce and involve much of the lung field. In many instances pulmonary tuberculosis follows upon silicosis, and the issue is not infrequently fatal. Some authorities believe that the initial fibrosis is caused by the silica dust disintegrating the ingesting phagocytes, but the exact mechanism appears to be imperfectly understood. The contraction of the fibrosis caused by the silica causes the air spaces in the rest of the lung to distend in order to fill the chest cavity. This condition is known as compensatory emphysema, and it is this which gives the well-known symptom of shortness of breath and liability to bronchial trouble. The hardening of the blood vessels in the affected tissue causes heavy increase of blood pressure on the right side of the heart. In the fatal cases of silicosis investigated up till 1947 in Great Britain more than half died with associated tuberculosis.[5] The onset of silicosis is insidious, and the condition is progressive and incurable. The use of flint for grit blasting is forbidden in factories in Great Britain, but sand blasting may still be carried out on site in the open air and, therefore, an understanding of the risk is essential.

Denny, Robson and Irwin[6] noted that the presence of small quantities of aluminium dust prevented silicotic material going into solution, and would decrease the occurrence of lesions. It would appear, therefore, that men spraying aluminium might be free from the risk of silicosis. Unfortunately, this does not appear to be the case.

Any dusts entering the lungs can bring about pneumoconioses, but none of those encountered in metal spraying is as dangerous as silica. Recently the opportunity occurred of examination of the lung of a man who had worked for 15 years in aluminium spraying, and although the aluminium content of the lung had increased slightly, no evidence was found of damage from this source. In shops where grit blasting is carried out with steel grit, the chief dust will be iron oxide, and this will enter the lungs. There seems as yet to be no evidence of any lasting damage, although the presence of the heavy particles, giving shadows on the X-ray screen, might lead to the wrong diagnosis of benign pneumoconiosis.

Among the dusts of the spraying shop will be that of zinc, and from two to eight hours after heavy exposure the victim experiences chills, followed by a fever. With the fever goes an increase in the number of white blood cells (leucocytes) and this persists after the fever has subsided. The victim feels debilitated and may suffer attacks of fever on successive days. During World War II a considerable amount of welding was carried out on galvanized steel for constructing light ships, and sharp attacks of zinc fume fever resulted, but the health of ship welders was good. The malady appears to be more distressing than dangerous. It is less likely to occur if the spraying pistol is working properly without excess of oxygen. The writer collected some evidence that exposure to the fumes of pistols spraying zinc had a beneficial effect on some cases of pulmonary tuberculosis.[7]

It is not only by way of the respiratory tract that the dusts formed in spraying enter the body. The grosser particles can enter the mouth during breathing, or be transferred to the mouth from the hands. Zinc, aluminium and iron seem to have little effect, but with such metals as lead and cadmium the results can be very serious.

In the early days of the company with which the writer is associated, owing to lack of appreciation of the danger, several very severe cases of lead poisoning occurred. With the help of the Inspectorate of Factories, necessary precautions were worked out and over the years no more trouble has occurred.

Lead is a cumulative poison, many small doses adding up to a final disastrous result. The lead entering the blood stream appears to remain in the marrow of the bones. In certain conditions the lead so retained will re-enter the blood and cause the splitting of the red corpuscles. Lead can remain dormant over a number of years, and the susceptibility to this form of poisoning varies considerably from man to man. The symptoms are increasing anaemia, constipation, colic, muscular weakness, and dropped wrists.

Accumulations of lead occur in the

gums, and can be seen as a blue line which is especially noticeable at the edge of the gums and natural teeth. Lead contamination in the body can be estimated from the results of urine analysis. Elkins[8] suggests that a concentration of 0·2 mg/L of lead in urine may be regarded as indicative of the upper safety limit.

Lead spraying must be carried out in a room fitted with very good exhausts, and the operator must wear a helmet, fed with clean air at positive pressure. He must wear special overalls and, if possible, gloves. He must be able to wash and bath in hot water. Some years ago in the Midlands, near Dudley, a man working with white lead maintained good health, but his wife became seriously ill from breathing the dust carried in his hair to the pillow. At one time it was believed that milk taken in large quantities would help, owing to its high calcium content. Calcium drives the lead into the bone, and calcium injections are given to relieve the colic. Frequent doses of laxatives are extremely effective.

Similar precautions must be taken with cadmium, a metal finding increasing use in metal spraying in the field of atomic energy. While lead fume is not unpleasant, the dust of cadmium brings about sneezing and lachrymation, so that precautionary measures are more easily enforced. Freshly generated cadmium oxide is so poisonous that it was considered as a war fume in World War I. It causes vomiting, chest pains and oedema of the lungs.

It must be remembered that grit blasting of steel which has been painted with lead paint or paints pigmented with cadmium yellow can be a hazardous occupation.

Tin should also be sprayed using the precautions outlined for lead. There is no evidence that this metal is highly toxic, but it is not easily absorbed and a small intake of tin dust causes vomiting.

It could be assumed that some bad effects would be observed from the spraying of copper and nickel alloys, but, perhaps because insufficient quantities are sprayed, no such effects have been reported. In passing, it should be noted that alloys containing manganese or vanadium should be used with great care. It is believed that comparatively small intakes may cause neurological disturbances similar to Parkinson's disease, although this is by no means proved.

Beryllium is a very dangerous metal, and is increasingly being used in nuclear power work. The metal can cause dermatitis, conjunctivitis and irritation of the upper respiratory tract. This may be followed by chronic lung disease and chemical pneumoconiosis, which may be fatal. X-ray examination shows fine nodulation.

Finally, one must consider the effects of fine dusts on the skin. It is reasonable to provide washing facilities but no serious troubles seem to have been noted as a result of sprayed dusts. In the writer's experience, there have been only two cases in which an operator, after working happily for some time, suddenly exhibited the swellings and painful watery blisters associated with dermatitis. After a period away from the works, the conditions completely cleared, but returned immediately the man came near the dust. An attempt was made to desensitize one of these cases by the injection of small particles of the dust, but that was not successful and the results were alarming. It seems, therefore, that if a man suddenly develops dermatitis he should change his occupation.

It is interesting to note that sprayed zinc will act as an antiseptic dressing to wounds, and is used as such on minor cuts by some metal sprayers.

The length of this Paper may seem to indicate that spraying and grit blasting are dangerous occupations, but this is by no means true. As stated at the beginning, the industry is no more hazardous than general engineering, provided that supervision is adequate and the dangers are understood by the management. There would seem to be many industries with a much more sombre health record.

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8 H. B. Elkins; "The Chemistry of Industrial Toxicology," John Wiley and Sons, New York.

Electrodeposited Coatings

COVERING such materials as electrodeposited zinc, cadmium, nickel, chromium, and lead for steel, a series of standards for "Electrodeposited Metallic Coatings" has been published by the American Society for Testing Materials. In addition, coatings for copper, copper-base alloys, zinc and zinc-base alloys are also covered. This edition for 1958 supersedes the previous issue in 1955.

Local thickness, acetic acid, and salt spray tests are included in this volume. To make the book more complete, recommended practices for preparing metals for plating are included.

In all, the book contains seven specifications, three methods of test, and nine recommended practices. Of the total 19 standards, five are new, recently revised, or have had their status changed within the year.

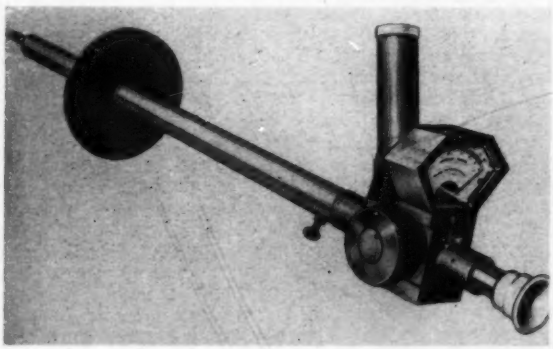
Copies of this book may be obtained from A.S.T.M. Headquarters, 1916 Race Street, Philadelphia 3, Pa., at $2.25 a copy.

Optical Pyrometry

FOR the temperature measurement of molten metals in crucibles and ladles, the Foster Instrument Co. Ltd., of Letchworth, Herts., is now marketing a pyrometer known as the Foster-Platt optical immersion pyrometer.

The optical axis of a disappearing filament type of optical pyrometer is extended in a light-tight tube, sealed at its outer end with a refractory sheath. On immersion in a bath of molten metal, its inner end assumes in a few seconds the temperature of the bath and, since the image of the pyrometer filament is permanently superimposed, a reading can be obtained quickly and accurately regardless of the type of alloy being tested. In most non-ferrous metals the refractory sheath will withstand up to 150 immersions, and 50 in cast iron.

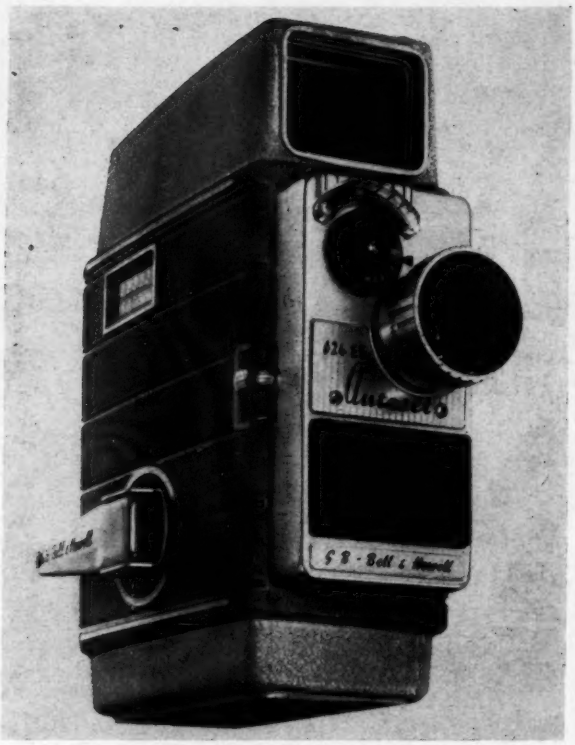
In the event of the sheath breaking, a new one can quickly be fitted at a small cost. The instrument is completely self-contained, having dry batteries with special high current cells contained in the tubular handle.



The Foster-Platt optical immersion pyrometer

Pressure Die-Casting Review

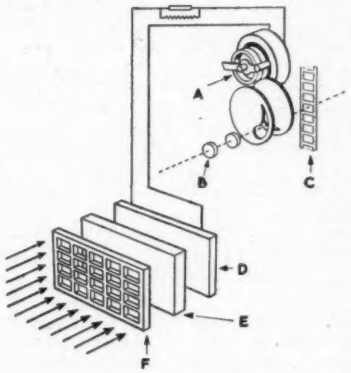
Die-Cast Cine Cameras



The G.B. Bell and Howell "Autoset" cine camera, an assembly based largely on pressure die-castings

ONE of the most outstanding developments in the amateur cine field in this country during the postwar years has been the introduction last year by G. B. Bell and Howell of the "Autoset" 8 mm. cine camera—the camera with the "electric eye." Manufactured by Rank Precision Industries Ltd., of Mitcheldean, Glos., this camera, like most of the G. B. Bell and Howell range, relies on pressure die-castings to provide a sturdy case of elegant design—one that can be rapidly and economically produced and attractively finished.

The illustration at the top of this page shows that the front panel of the "Autoset" camera carries the lens mount, a control knob, and, below the lens, a rectangular baffle or grille. Through this baffle, light enters from the subject to be filmed and is filtered before it impinges upon a photo-electric cell which, under the action of light, emits an electric current of sufficient intensity to operate a computer or meter. This, in turn, rotates a pair of thin metal discs, each of which is pierced by a pear-shaped aperture. As the discs rotate, the apertures, which are in opposition to each other (Fig. 1) move in a relationship which opens or closes the actual gap through which the light is allowed to pass as it leaves the lens. The movement of the discs is continuous and automatic, altering with any change in the intensity of the light falling on the subject.



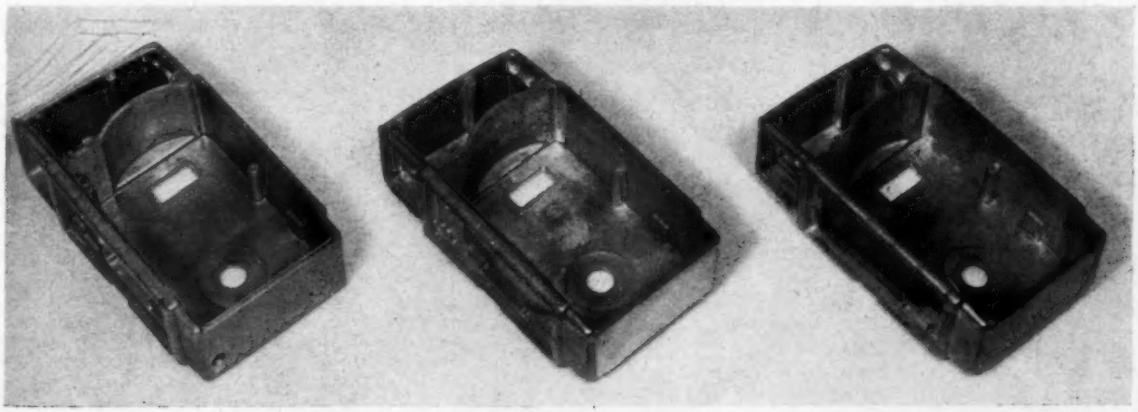
A—Computer. B—Lens. C—Film.
D—Photoelectric cell. E—Filter. F—Baffle.

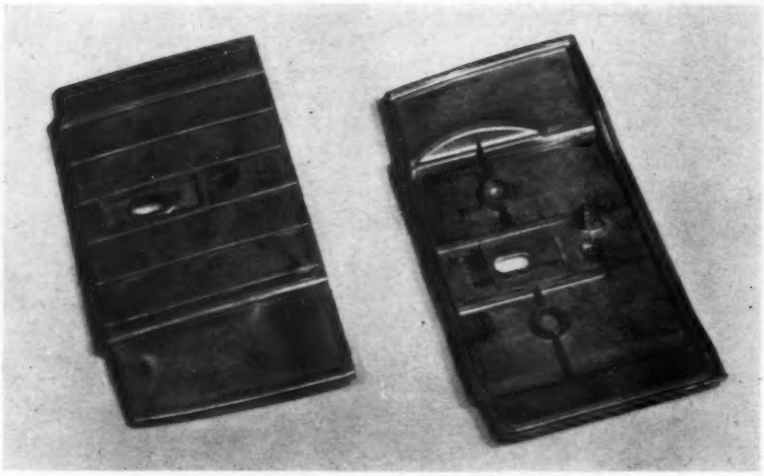
Fig. 1

It is this "electric eye" that has made the model 624 EE "Autoset" the most advanced development in amateur movies, and die-casting, as will be shown, serves the construction of the "electric eye" and the camera as a whole.

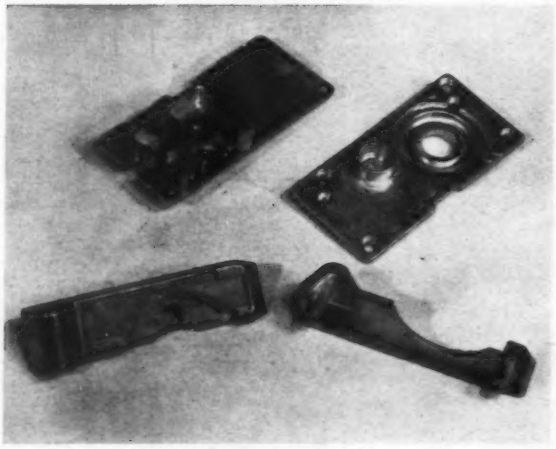
Cast in aluminium alloy, the case of the 624 EE is similar to its forerunner, the 624, the same dies being used in the production of the castings, but an interchangeable insert of different shape is used for each type. In Fig. 2, the two castings on the left are for 624 cameras, that on the right for the newer 624 EE. It will be seen that

Fig. 2—Three types of body casting: those on the left are for the Model 624, the one on the right being for the 624 EE—the "Autoset." The dies are similar, but different die inserts are used to produce the alternate forms



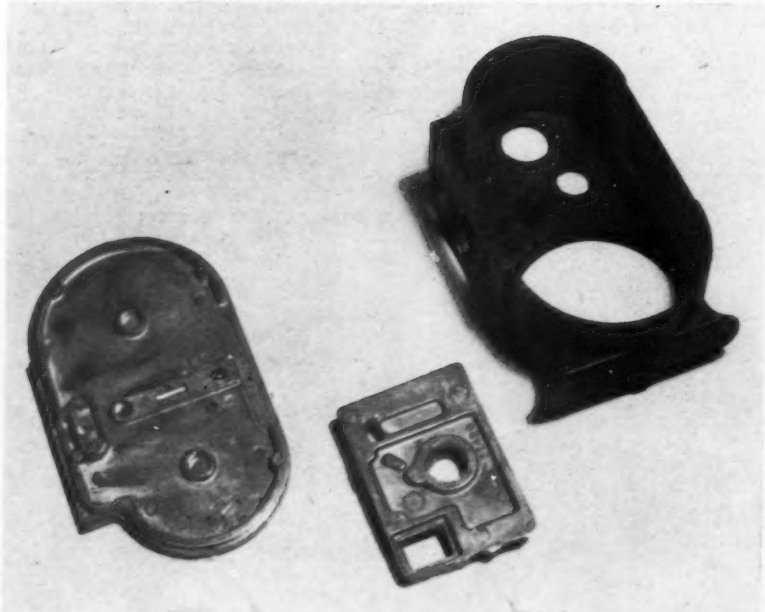


Above: Fig. 3—Pressure die-cast doors for the "Autoset"



Left: Fig. 4—The front plate (top) and support plate (bottom)

Below: Fig. 5—Three castings for the "Sportster." The body, on the right, is partly machined



there is a difference in shape in the front panel aperture between the two types, but in other respects they are identical.

In each of these castings, the assembly requirements are, as far as possible, incorporated. Fixing lugs, bosses, a light trap for the door, apertures for the controls and indicators, and the viewfinder housings, are all cast-in, and machining is kept at a minimum; four milling operations, drilling and tapping are the only work on the casting.

On the outer side are cast horizontal grooves as part of the styling, and recesses for the footage meter, the winder, starting button, and the viewfinder lenses. The box form provides ample rigidity while allowing relatively thin walls, thus keeping down weight.

The casting for the door is shown in Fig. 3. In this, the horizontal grooving is continued, and a recess and aperture for the door button are cast in. The inner face is ribbed, has a channel light trap around its edge, and has two bosses and a small pillar cast-in. On this casting only three machining operations are carried out.

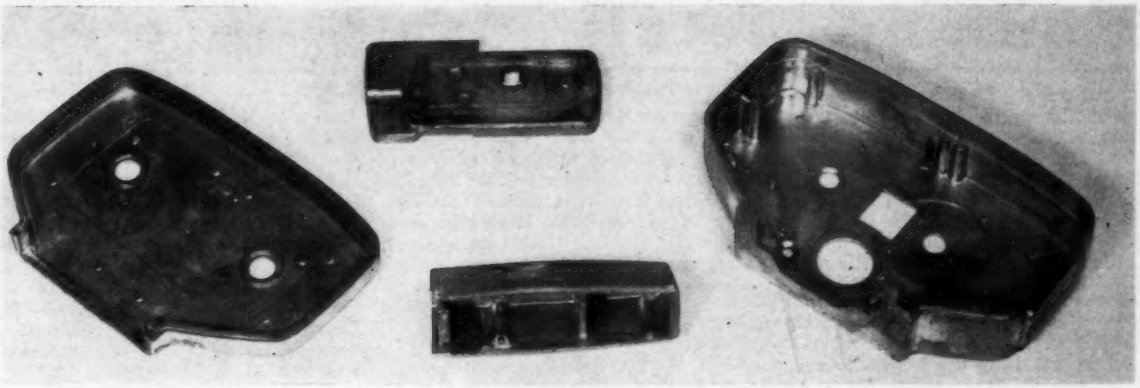
In Fig. 4 are the castings for the front plate and support plate of the 624 EE and the 624 cameras. The front plate (left) of the 624 EE has cored apertures for the lens, the meter control, four fixing screws, and a cast-in angular slot for the exposure beacon —a warning device which can be seen in the viewfinder and changes from yellow to black if there is insufficient light to give a satisfactory exposure. On the reverse side of the plate are a cast-in web, and bosses. This casting, which carries the lens and "electric eye" assembly, has the meter control recess bored, the lens boss stepped, and a recess dimpled.

The other front plate (right) is similar in general shape, but provision is made in the casting for manual shutter setting, the large recess at the bottom housing this device.

The support plates, also in Fig. 4, are carried behind the front plate in the assembly, the film passing across the forward face, between the plate and the pressure shoe. It is thus the relationship between this face and the lens mounting which controls the focal plane of the camera, each camera being finally collimated to a high degree.

These castings, the case, door, front plate and support plate, form the main structure of the "Autoset" camera, and upon the accuracy of the die-castings and their rigidity much of the success of the camera depends. That it is being produced at a price well down in the scale for cine cameras is another tribute to the facility that die-casting offers for high-speed economic production.

Among the other cameras in the G.B. Bell and Howell range are the 605 "Sportster" and, a recent introduction, the 627 16 mm. camera. The "Sportster" has been a popular camera for some years, and the three castings



used in its construction are shown in Fig. 5.

The body shown is a casting after machining, which includes a number of drilled holes, milling and facing. The foot, bosses, lugs and recesses are all cast-in, as they are also on the door and front plate. Only one type of front plate is shown but another pattern, longer than the standard, is also fitted to take a twin lens turret.

In the model 627 camera, a different class of camera is encountered. This is a more elaborate model, larger, more robust, and designed ingeniously to eliminate the initial hand threading of the film through the gate. The chief die-castings used in this camera are shown in Fig. 6. They are the case, cover, front plate, and viewfinder housing.

As in the other castings, these incorporate a cast-in light trap, fixing bosses, screw holes, and apertures for the winder, footage meter, etc. The viewfinder housing is provided with bosses for attachment to the body.

The front plate has recesses on either side, with elongated and rectangular apertures. A small hole which passes through the wall at one end of one recess into a further recess on the other side of the plate is one of those examples, so common in die-casting, where pressure die-casting does readily what would be difficult to achieve by drilling.

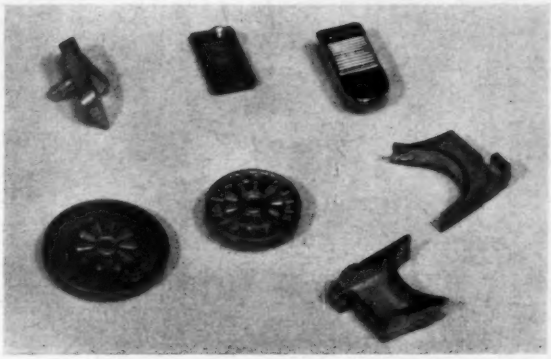
In Fig. 7 are shown some of the smaller die-castings used in these cameras. Door buttons, starter button, footage indicators, and several other small items are cast in aluminium or zinc alloy to fulfil many minor purposes in the assemblies. The two loops, for instance, on the right, are part of the self-loading device on the 627 model, and guide the film when the door is open, springing out of position when the door is closed. The dial in the centre has cast-in numerals to indicate the camera speed, and door buttons have cast-in serrations to provide a grip and letters to indicate the direction of movement.

A magazine type camera, the 603 "Autoload," also uses a number of die-castings, and these are shown in Fig. 8. The cover, in this case, has a number of cast-in bosses which provide fixing

Above: Fig. 6—The major die-castings for the Model 627, a larger camera, with self-threading film mechanism

Right: Fig. 7—Some of the smaller parts produced as pressure die-castings

Below: Fig. 8—Die-castings for the "Autoload," a magazine-loading cine camera



points for various members of the assembly. The other castings employ similar devices to obviate machining operations and minimize assembly problems.

One aspect of this production that should be touched on is the rigid quality control exercised by Rank Precision Industries over all their products. Incoming castings, for instance, are sampled at random, the sampling history being recorded for each batch. Minor defects may be rectified, rather than returning the batch to the supplier, especially as there is a constant demand for castings from production.

All defects, dimensional or otherwise, are, however, recorded, and thus a useful reference history is built up. This enables the firm to see if a particular defect is recurrent, or if a dimension is steadily opening out, and also permits reliable evidence to be presented to suppliers so that they, too, can watch for the defect and avoid its recurrence where possible. The system also serves as a guide to the designers as to what tolerances may be too close to be held successfully.

Men and Metals

Superintendent of the National Physical Laboratory's Metallurgy Division, **Dr. N. P. Allen,** F.R.S., is to deliver the Eleventh Hatfield Memorial Lecture on December 9 next at the Weir Lecture Hall of The Institution of Naval Architects, London.

At the meeting of the Birmingham Metallurgical Society, held on Thursday of last week, **Dr. Robert King,** B.Sc., Ph.D., A.R.I.C., A.I.M., took office as President for the year 1958-59. Educated at the Central Secondary

School and King Edward's School, Birmingham, Dr. King graduated at Birmingham University and eventually joined what is now the Copper Products Section of I.C.I. Metals Division, as a technical officer in the production department. He served in various departments until appointed assistant technical manager in 1956. He was seconded to the Allied Control Commission for Germany during 1945-7 for work with the non-ferrous metals control section. He returned to Birmingham University for 12 months in 1950 for the engineering production course.

At the annual general meeting of the Midland Metal and Allied Trades Association, held at Hereford recently, **Mr. F. E. D. Burke** was re-elected President, and **Mr. C. C. M. Burley** appointed vice-president and deputy chairman.

The appointment of **Mr. Arthur Griffiths,** O.B.E., M.I.P.E., as group managing director of Sterling Industries Limited, has been announced.

Mr. Griffiths has been director and general manager of The Daimler Company Limited since 1956. Prior to this he was director and general manager of F. Perkins Limited, from 1948 to 1956, and previously held senior positions with the Ford Motor Company for 17 years. The Sterling Industries Group controls Dualloys Limited, Sintered Metal Components Limited, the Sterling Instrument Company Limited, and Exactor Limited.

Recent appointments made by B. O. Morris Limited include the following: **Mr. J. T. Troman** to be a director of the machine tool division at Portsmouth; **Mr. O. G. Eves** to be works director at Coventry; and **Mr. L. Smith** to be a director of Bramble Engineering Company Limited.

Office bearers and the executive committee for the year 1958-59 for the British Valve Manufacturers' Association are announced as follows:—**Mr. J. W. Plowman** (Dewrance and Company Limited) re-elected chairman; **Mr. N. P. Newman** (Newman, Hender and Company Limited) re-elected vice-chairman; members of the executive committee—**Mr. D. Bailey** (Sir W. H. Bailey and Company Limited); **Mr. F. T. Bintcliffe** (J. Blakeborough and Sons Limited); **Mr. F. Burgess** (Whites-Nunan Limited); **Mr. G. F. Chambers** (The Bryan Donkin Company Limited); **Mr. A. E. Dickinson** (Smith Brothers and Company (Hyson) Limited); **Mr. D. S. Gardner** (Glenfield and Kennedy Limited); **Mr. F. S. Ham** (Ham, Baker and Company Limited); **Mr. H. R. Hammond** (Crane Limited); **Mr. K. M. Leach** (Audley Engineering Company Limited); **Mr. T. B. Pattison** (Alley and MacLellan Limited).

Members of the staff of Wolf Electric Tools Limited have recently been elected to the board of directors as follows:—**Mr. N. McCann,** secretary of the company since June, 1945; **Mr. R. G. J. Nisbet,** to be director of Canadian operations; he was appointed general manager of the Toronto branch in 1952; **Mr. J. A. Jackson,** to be works director; and **Mr. W. N. Scottorn,** to be sales director.

An announcement has been made by The British Oxygen Company Limited to the effect that **Mr. G. C. R. Eley,** C.B.E., has joined the board of the company.

High Temperature Lubrication

LUBRICATION at temperatures of 540°C. and higher, which poses a major problem in aircraft and missile development, may be achieved with the same chemical that is used to cool refrigerators.

Several gases of the Freon family, widely used as refrigerants, have been found to lubricate various metal alloys at temperatures up to 650°C., according to a Paper given at the 134th national meeting of the American Chemical Society, held in Chicago, Illinois.

Gaseous lubricants function by combining chemically with the metal to be lubricated and forming a film that reduces friction, but only certain gases will react with particular metals to create such a lubricating compound. Certain nickel and cobalt alloys are effectively lubricated by the gases, known chemically as dichlorodifluoromethane, dibromodifluoromethane, and monobromotrifluoromethane.

The first-named of these gases has the trade name Freon-12, and the others are close chemical relatives. The presence of another gas, sulphur hexafluoride, in small amounts is generally beneficial to the formation of the lubricating film.

Freon-12 has proved an effective lubricant for such iron materials as M-1 tool steel at low temperatures, but the metal was corroded by the gas at temperatures above 316°C. In view of the corrosive action on iron, attention was turned to the use of alloys based on nickel or cobalt.

Frictional heat may produce temperatures at the point of contact as much as 593°C. above the surroundings, and the lubricating gas decomposes at these local hot spots. Active atoms thus released react with the metal to form compounds capable of effective lubrication. Thus the lubricants are continuously re-formed as needed.

Gases containing bromine atoms were found to be more effective with nickel alloys, and the chlorine-containing gases were more effective with cobalt alloys.

Optimum combinations give friction coefficients as low as 0·05 without excessive wear. An example of an effective combination is Stellite 98M2 (cobalt, chromium and tungsten) on Hastelloy C (nickel, iron and molybdenum) in monobromotrifluoromethane plus 1 per cent sulphur hexafluoride, at temperatures from 316°C. to 650°C.

The friction studies were made using a hemispherical rider, $\frac{3}{8}$ in. in diameter, sliding in a circumferential path on the flat surface of a rotating disc $2\frac{1}{2}$ in. in diameter. A pressure of about $2\frac{1}{2}$ lb. was applied to the rider and the sliding velocity was 120 ft/min. The apparatus was run in an atmosphere of the lubricating gas at temperatures ranging from 24°C. to 650°C.

Research Progress

Pitting Corrosion

BY RECORDER

IN many cases of corrosion, attack occurs fairly uniformly over the whole surface of the corroding metal. In these instances, then, the corrosion rate can be determined and the service life of any particular component predicted with some confidence. Some metals in certain environments do not corrode uniformly, however, attack occurring locally, probably at defects in a protective surface film. The pits so formed are likely to vary appreciably in size and depth. In such circumstances, the corrosion "rate" is difficult to define and, since the perforation of a component by only one pit may render that article useless, the probable service life, too, is hard to assess. Clearly, some method of determining the resistance to pitting corrosion is required that will not only give the general corrodibility but also allow estimates to be made of the maximum rate of penetration likely to occur, even though this rate may be found at only a few points on the metal.

The problem has been studied recently[1] by T. J. Summerson, M. J. Pryor, D. S. Keir and R. J. Hogan, of the Kaiser Aluminium and Chemical Corp., Spokane. The pitting corrosion examined was that of four aluminium alloys (see Table I) in marine conditions.

Flat, 6 in × 12 in. sheet panels were immersed below low tide level at a river mouth and one panel of each alloy withdrawn after 6, 12 and 24 months' exposure. Corrosion products, marine growths, etc., were removed by mechanical and chemical methods, and the overall weight loss established. The mechanical properties of each sheet were determined, and compared with those of control specimens stored at ambient temperature for a corresponding period. The depth of each pit on each side of the panels was measured to the nearest 0·0005 in., using a dial gauge, needle point penetrometer. Pits lying within 1 in. of the sides and 2 in. of the ends of the sheets were ignored to eliminate edge effects, and penetrations less than 0·0005 in. though present, were also discounted since the instrument was insufficiently sensitive. Despite these omissions, a large number of measurements were required, and it appears that the depths of nearly 24,000 pits were ascertained, over 7,500 of these being on one panel alone.

The pit depths were next grouped in increments of 0·001 in. depth, and a plot of number of pits against pit depth prepared for each alloy and each immersion time. The distribution curves so obtained were not Gaussian, and the maximum population occurred at a low value of pit depth in all cases. Indeed, for the first three alloys of Table I at 6 and 12 months' exposures the maxima were all in the 0-0·001 in. group of pits, the numbers in succeeding increments falling fairly sharply to small values. It was found by graphical methods, however, that the curves were skewed, and that a significant relationship existed between the square root of the pit depth and the population at that depth. The distribution curves replotted as number of pits against the square root of pit depth gave closer approximations to typical Gaussian forms, especially at the two longer periods of immersion. The asymmetry of these curves could probably be attributed to the "cut-off" of readings at the 0·0005 in. depth level, though the authors admit that a change in the mechanism of pitting, particularly during the shorter immersion periods, might lead to this lack of symmetry. It would seem possible that this question could have been resolved by counting the number of pits that were visible but less than 0·0005 in. in depth. By this means some estimate of the pit population lying below the "cut-off" point could have been made, and an indication obtained whether or not this value could satisfy the requirements of a typical Gaussian form.

The mean square root pit depth and the standard deviation of this mean were obtained graphically, and the probable error (at 90 per cent confidence) by calculation. The first of these values was compared for each alloy, and exposure time with the average depth of penetration calculated from the weight loss of the sample assuming the attack to have been uniform. The results are given in Table II.

It would seem reasonable to expect that the measured mean pit depth would always exceed the "uniform" depth of penetration, and the results show that this is so with one singular exception—that of alloy 5052 exposed for 12 months. This anomalous finding could, perhaps, be due to the formation of a number of large, deep pits on the sample, but from the distribution curves given in the Paper this does not seem to have been the case. The authors do not refer to this detail.

The fact that the mean pit depth after 12 months' exposure is less than those after both 6 and 24 months' immersion for alloy 5052 is not unique, however, alloy 5050 also exhibiting a similar pattern. The fourth material, 6061, is here exceptional, since the depth after 12 months was considerably greater than for either the shorter or longer period. Summerson and his colleagues suggest that differences in behaviour of this sort will provide an insight into the mechanism of pitting corrosion, especially when the frequency of pitting and the standard deviation are also taken into account. The latter value is used to indicate the

TABLE I—ALLOYS USED

Alloy	Si	Fe	Cu	Mn	Mg	Cr
3003—H14	0·19	0·53	0·16	1·13	0·02	—
5050—H34	0·24	0·56	0·12	0·02	1·42	—
5052—H34	0·07	0·20	0·05	—	2·36	0·21
6061—T4	0·61	0·51	0·34	0·05	0·96	0·26

TABLE II—COMPARISON OF PENETRATION RATES

Alloy	Months of Exposure	"Uniform" Depth of Penetration*	Actual Mean Pit Depth*
3003	6	0·4	0·6
	12	0·6	1·2
	24	0·8	1·3
5050	6	0·4	0·8
	12	0·5	0·6
	24	0·6	2·0
5052	6	0·4	0·6
	12	0·5	0·2
	24	0·7	1·6
6061	6	0·5	1·5
	12	0·6	2·2
	24	0·8	1·3

* *In thousandths of* 1 *in.*

range in pit depths, a high deviation suggesting the presence of relatively deep pits. Although this may be so from a mathematical standpoint, it is unfortunate that the authors do not attempt to show how their own results on the four aluminium alloys bear out the contention. They do make the point that frequency of pitting must also be considered, since the number of pits may be reduced by agglomeration or combination into large pits, but here it would seem that practically the same information would be obtained by simple visual counts of the number of pits combined with weight loss measurements unless a quantitative approach is adopted. Indeed, it is difficult to determine how useful the techniques employed by Summerson *et al* will prove to be on the evidence they present, as the data in their Paper are interpreted in only generalized terms.

Reference

[1] T. J. Summerson, M. J. Pryor, D. S. Keir and R. J. Hogan; A.S.T.M. Special Technical Publication, No. 196, 1957, 157.

Forging Press Conversion

CAPACITY for the production of hand forgings at Northern Aluminium Company's Birmingham works has been greatly increased by the recent installation of a 4,000 ton direct-acting hydraulic press. It is also available for closed-die and no-draft forgings, and for the pre-working of cast stock prior to rolling and extrusion in the company's works at Banbury and Rogerstone.

The press, which was originally installed in Germany, has been extensively rebuilt according to recommendations made by The Loewy Engineering Company Ltd.

Too high for Northern Aluminium Company's forging bay, the main alteration has been the replacement of two ram retracting cylinders mounted at the top of the press by two push-back cylinders, so reducing the height to 27 ft.

The press is fitted with ejector gear, which takes the form of a 24 in. dia. ram housed in a foundation 17 ft. deep. From the bed plate, rise the four main columns, 16 in. in diameter, surmounting which is the top crosshead. Below this is secured the main ram, 53 in. in diameter, on which the main cylinder, with the bolster secured to its lower face, moves up and down. Because of this principle of operation, the main cylinder has guides at its top and bottom, giving very accurate alignment between the upper and lower platens. The working space between the columns is 7 ft. and the press has a stroke of 6 ft., which permits 9 ft. 1 in. of daylight between top and bottom platens.

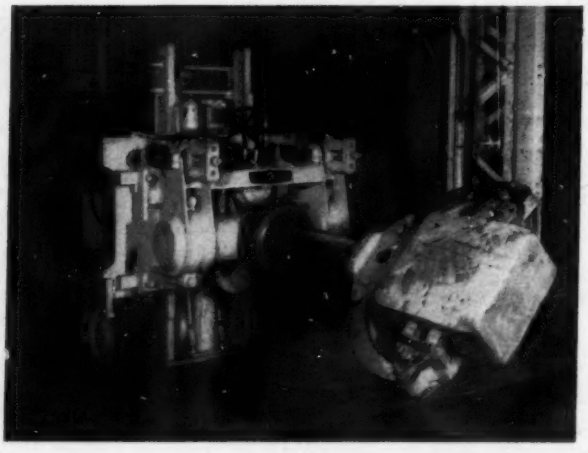
Operation of the press is by means of a modern system of fingertip control through electro-hydraulic valves, with a range of speeds varying from 0·08 in. to 0·50 in/sec. This variation in speed is achieved by the selective use of twelve Fraser mono-radial pumps, each driven by a 50 h.p. motor capable of delivering oil to the press at a rate of 20 gal/min. To lower the cylinder, oil is passed into it from a 2,500 gal. refill tank, under an air pressure of about 50 lb/in^2; when contact is made with the work, the prefill valve closes and the pumps take over, delivering oil direct to the press at a total pressure of 4,000 lb/in^2.

The press was originally laid down to increase the scope of the hand forgings, and among those already produced are several weighing 1,500 lb. each. In conjunction with the 45,000 lb. hammer already installed, it will also enable the company to offer bigger closed-die forgings, up to about 700 lb. in weight, and it has already proved its usefulness in enabling cast stock to be preworked more economically, and in bigger sizes, than hitherto.

The handling of such large sizes during hand forging would clearly be impossible by the usual method, namely suspension from an overhead crane and manipulation by tongs. A mechanical manipulator has, therefore, been brought into use, which is essentially a hydraulically-operated arm, incorporating a means of gripping the stock, mounted on a fork-lift truck. The actual manipulating mechanism, which is of Salem Brosius design, made under licence by Head Wrightson and Co. Ltd. and styled a "Manipulet," has a capacity of 1,500 lb. It has great flexibility of movement, enabling the stock to be hoisted, lowered, tilted, moved from side to side, and rotated through 360°, without the truck having to be moved. Of Yale and Towne design, the truck itself has a capacity of 10,000 lb., which includes the power required to operate the hydraulic system of the Manipulet.

Left : The 4,000 ton hydraulic press installed at Northern Aluminium Company for large hand forgings

Below : The mechanical manipulator for handling forging stock



Industrial News *Home and Overseas*

Postgraduate Foundry Course

As part of its postgraduate foundry course, the **University of Birmingham** is holding a short course dealing with the theoretical and practical aspects of structure in castings, from Monday, December 15, to Wednesday, December 17, next. The attendance fee for the course is two guineas. Further particulars are available on application to the Secretary, The Department of Industrial Metallurgy, The University of Birmingham, Birmingham, 15.

Bronze and Brass Founders

A meeting of members in the Lancashire and Cheshire area of the **Association of Bronze and Brass Founders** is to be held on Monday, November 24, at 4.30 p.m., at The Engineers' Club, Albert Square, Manchester. After matters of current interest have been discussed, an open meeting will be held, at which the association's new publication, "Costing a Casting" will be introduced, explained and discussed.

A Technical Service

A live-wire team of application and design experts to give free advice on the use of their wide range of equipment is one result of the **Baldwin Instrument Company's** recent expansion of their facilities. The other result is greatly reduced delivery times, in many cases now ex stock, for high quality standard equipment.

This team will have behind them their many years' experience of designing systems combining hydraulics and pneumatics, as well as the resources of the Baldwin electronic division, and in offering advice on complete installations, whether under pneumatic, hydraulic, or electrical control, provide a unique service to industry.

Vacuum Furnace Order

An order for a special 50 lb. induction vacuum furnace has been received by **Wild-Barfield Electric Furnaces Ltd.** from Bristol Aero-Engines Ltd. This furnace will be equipped with a high-speed pumping system, and three different sizes of crucible and coil will be supplied. A 22 in. diameter external mould chamber will be incorporated for the introduction of hot moulds.

Aluminium Cars

Speaking at Sheffield (Alabama) recently, Mr. A. D. Reynolds, vice-president of Reynolds Aluminium Sales Company, said that an all-aluminium automobile was "no pipe dream." He declared that such an automobile "would be competitive in costs with current production, weigh 60 per cent less, and set off a chain reaction of improved performance, economy and beauty not otherwise available." He pointed out that during the past five years the average amount of aluminium per passenger car had increased from 30 to 57 lb. He added that indications were that aluminium consumption in automotive use would more than treble in the next decade.

Mr. C. H. Patterson, a vice-president of the Ford Motor Company, said that work was under way on an aluminium engine block. He made what he called "a conservative prediction" that within five years the average car would contain from 100 to 120 lb. of aluminium. He said the Fairlane Ford model of 1959 contained 68 lb. of aluminium, against 6 lb. shortly after the end of World War II.

High Frequency Induction

To further the study of biomechanics at the University of London's Faculty of Engineering, a high frequency induction melting equipment, designed and supplied by **The General Electric Company Ltd.** has been installed at King's College. The induction furnace meets a need for a convenient method of melting, with minimum contamination, small quantities of metals both for fabricating experimental parts and for producing alloys to be tested for mechanical properties and biological compatibilities.

Considerable progress has already been made in the surgical treatment of diseases of leg bones using metal inplants made of cobalt-chrome-molybdenum alloy. The induction heating equipment will melt 10 lb. of cobalt-chrome-molybdenum alloy in 20 min.

New Agency

Following the recent visit of Mr. G. Godwin, managing director of **Martonair Ltd.,** to Italy, the appointment of Vagnone and Boeri, of Turin, as agents for Martonair pneumatic equipment in Italy has been announced. Vagnone and Boeri also have offices in Milan and Rome. The Martonair organization is now represented by associated companies or agents in Australia, Austria, Belgium, Canada, Denmark, Finland, Germany, Holland, Iceland, Italy, New Zealand, Norway, South Africa, Spain, Sweden, and the U.S.A.

Die-Casting Press

Further news has come to hand of the giant Triulzi M 25 press which **J. V. Murcott Limited,** of Birmingham, have acquired. This machine, believed to be the largest of its type in this country, has now reached the Murcott works at Aston, Birmingham, installation is well under way, and production is scheduled to start in January next.

This extension of the Murcott facilities will enable the company to cater for a wider section of industry, and the interest already shown in the installation of this large press has been most encouraging, and we understand that several contracts have already been accepted.

British Equipment for Canada

In co-operation with the **Birmingham Engineering Centre,** the Board of Trade is organizing a display of British engineering products at the National Industrial Production Show, to be held in Toronto, Canada, from May 4 to 8, 1959. It is understood that the Birmingham Engineering Centre proposes to rent from 3,000 to 4,000 ft^2, and the Board of Trade will have its own display, occupying some 1,000 ft^2.

The National Industrial Production Show is a specialized event, held every two years, exclusively for plant executives, production and maintenance men, engineers, and others directly interested in plant production, operation and maintenance. It is not open to the general public. In previous years, machinery, machine tools, materials handling equipment, welding equipment, hydraulic, pneumatic and electronic equipment and controls, automation equipment, etc., have been displayed.

United Kingdom firms interested in taking part in this exhibition should obtain further details from Mr. A. J. Cox, Birmingham Exchange and Engineering Centre, Stephenson Place, Birmingham, 2.

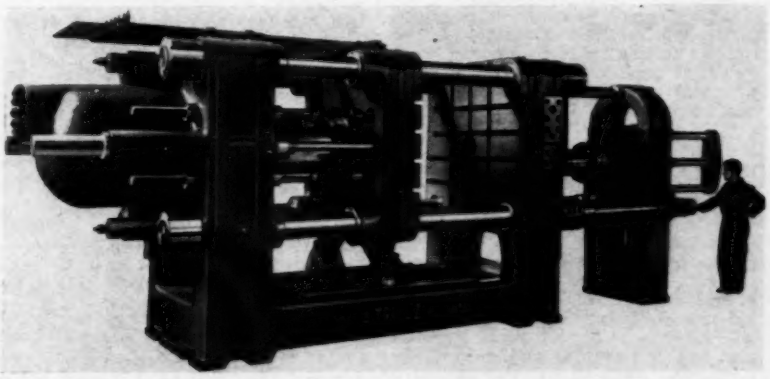
At Brussels Exhibition

As part of the Engineering Centre Collective Exhibit at the Brussels World Exhibition, 1958, **Platt Metals Ltd.** were among those awarded a gold medal. The award was given for design, presentation and appearance of their stand.

Changed Telephone Number

Notification has been received from **Auxiliary Rolling Machinery Ltd.** to the effect that, as from December 1 next, their telephone number will be changed to Tipton 2617-18-19.

The Triulzi M25 press at the Birmingham works of J. V. Murcott Ltd.



A general view of the jubilee dinner of Alfred Case and Co. Ltd.

Jubilee Celebrations

In celebration of their Silver Jubilee, the directors of **Alfred Case and Company Ltd.** recently entertained the entire works and staff to a jubilee dinner at the George Hotel, Walsall. The company became securely established as non-ferrous strip rollers when the West family took over the business in 1933, and several of the original employees are still serving with the company. The firm, always operated as a family concern, became a public company in 1952, but the direct contact between workpeople and directors is maintained.

The four directors, **Mr. K. E. West,** chairman and managing director, **Mr. H. A. West, Mr. E. F. West,** and **Mr. T. M. West,** maintain a personal and active interest in the running of the business, and, on the occasion of the jubilee celebrations, Mr. K. E. West presented gold watches to Miss M. Stone, Mr. A. Portman, Mr. T. Crowther, Mr. W. Moon, Mr. G. Davis, Mr. G. Jackson, Mr. P. Henrick, and Mr. T. Davis, who have been with the firm for 25 years.

On behalf of the other directors, Mr. K. E. West presented a silver salver and glass vase to Mr. H. A. West, who was formerly managing director and who now serves in an advisory capacity. For one of the company's employees who was in hospital and unable to be present at the function, a special gift parcel was prepared to mark the occasion. Our photograph on this page shows a general view of the guests at the dinner.

A Glasgow Exhibit

A series of demonstrations of the use of electricity for industrial heating processes will be the main feature on the stand of the **Electrical Development Association** at the Electro-Heat and Productivity Exhibition at Kelvin Hall, Glasgow, next week.

One of the exhibits will include a vibrating screen for sifting wet sand, clay, gravel, slag, and similar material. Another specialized application of electricity, the ultrasonic flaw detector, will indicate the wide field of use of this non-destructive testing device. It enables machined parts, forgings, welded joints and raw material to be examined for the presence of cracks, slag inclusions, and other defects. A section of the stand will also be devoted to a display of the books in the E.D.A. electricity and productivity series, and attention will also be drawn to the availability of the association's series of films on industrial electrification, in particular the latest film, "Electro-Heat in Industry."

New Ring Rolling Mill

On Wednesday last, a number of guests were invited by **N. Hingley and Sons (Netherton) Ltd.,** to visit the Netherton works, and later to a reception and luncheon at the Hingley Hall and Hingley Athletic Ground. During the visit to the works, and the later demonstrations in the Hingley Hall, special attention was directed to the plant and products of the Hingley forge division.

A special feature of the day's proceedings was the official opening of the new ring rolling mill, designed and built at Netherton. The opening was signalized by the chairman of the company, Mr. Cyril Lloyd, who "threw over" the starting switch, and thereupon steel and alloy rings were rolled on this mill. These rings, and also the products from the other mills and hammers, are supplied in all qualities of steel, stainless alloys, Nimonic series, titanium, light alloys, etc., and have been supplied over a period of years for many engineering purposes.

Apart from the conventional uses to which such rings have been put, there are the special applications of the alloy metals, which possess the properties necessary for the modern power units which are used in aircraft, and for various special applications in the field of atomic energy.

The new ring mill stands in the Netherton Forge, which has been operating and using conventional forging plant for 120 years. The history of the forge started with the helve; then, in 1850, Nasmyth himself assisted in the erection of the first steam hammer to be built in the Midlands. The visitors were also able to see a display, staged by the Group Research Company, illustrating the controls which are exercised over production, and the nature of the development work which is being undertaken by the company. Products of the forge, smithy and foundry were seen during the visit, as well as various departments, including those providing for the training of apprentices.

Telex to Australia

A Telex service between the United Kingdom and Australia has just been opened. This service, which will be available on weekdays only, between 2 a.m. and 10 p.m., will cost £3 for a call of up to three minutes and each additional minute or part of a minute will be charged at £1.

This new service has been introduced by the authorities in both countries as a result of a demand from Telex subscribers in both. It is expected to facilitate business working by making possible exchange of messages with the speed of the telephone and with the authority of the written word. For instance, one advantage will be that a British business man will be able to transmit a message before he leaves his office, knowing that his Australian correspondent will be able to see it as soon as he arrives at his place of business the next day.

For the Foundry Industry

Under the trade name of "Marikor," a special core oil has been developed to meet the requirements of the foundry industry. This oil is available from **Charles H. Windschuegl Ltd.,** who are also importers of Marinol K, of which Marikor is a derivative. This new oil is stated to be free from unpleasant odour, and has been proved efficient and economical in actual foundry tests.

Aluminium Agreement

It is reported from Tokyo that the Furukawa Electric Company, a leading Japanese non-ferrous metal producer, has concluded a contract with the Aluminum Company of America (Alcoa) for the joint organization of a new company in Japan to make rolled aluminium products. The project, whereby Alcoa will supply technical and managerial assistance and production equipment to the Japanese mill, is designed to reduce the cost and improve the quality of rolled aluminium goods. The contract has been submitted to the Japanese Government for approval.

Under the contract, Furukawa is to supply the new company with buildings and equipment worth 1,100 million yen, while Alcoa will provide patent rights, technical know-how, and machinery valued at 590 million yen. Both the Japanese and American companies will get shares of the new company. The part of the contract concerning the technical tie-up is valid for 15 years, during which time the new company is required to pay 1·5 per cent of its sales proceeds to Alcoa as royalties.

Mr. Furukawa said the new company, to be named the Furukawa Aluminium

Company, is expected to start operation from next year, with an initial production capacity of 12,480 tons. Capacity will be expanded by about 2,000 tons annually to reach 40,000 tons by 1973. Mr. Furukawa also said that during the 15-year period the new company was expected to export about 77,000 tons of aluminium products, and earn about 50,000,000 dollars' worth of foreign exchange. The Furukawa Electric Company is affiliated with the Japan Light Metals Company, which has a capital and technical tie-up with Aluminum Limited of Canada.

Copper Stockpile

The Board of Trade announce that they are offering 10,000 tons of copper for delivery and pricing during the period mid-November, 1958, to end of January, 1959. Some 8,000 tons of this copper will be offered to the original suppliers or their agents, and the remainder by open tender.

In addition, a small quantity of copper cakes is being released to consumers immediately.

Application may now be made to the Board of Trade, General Division 7, Lacon House, Theobalds Road, W.C.1, for tender forms, which will be issued in a few days.

U.K. Metal Stocks

Stocks of refined tin in London Metal Exchange official warehouses at the end of the week to November 1 totalled 17,611 tons, comprising London 6,119, Liverpool 9,987, and Hull 1,505 tons. At the end of the preceding week, stocks were 17,652 tons, and the breakdown was London 6,125, Liverpool 10,017, and Hull 1,510 tons.

Copper stocks showed a sharp fall at 6,610 tons and comprised London 4,375, Liverpool 1,735, Birmingham 125, Manchester 250, and Swansea 125 tons. A week earlier they stood at 8,234 tons, divided between London 4,900, Liverpool 2,709, Birmingham 175, Manchester 300, and Swansea 150 tons.

Powder Metallurgy

An interesting booklet entitled "Sintered Components for Engineers" has been produced by **Basildon Metal Powder Parts Ltd.** In this twelve-page booklet an effort has been made to convey some idea of the possibilities offered for the manufacture of machine components in large quantities from metal powders, to high standards of finish and dimensional accuracy.

As the booklet points out, a wide variety of materials are available, manufactured to closely controlled specifications in both composition and structure. Modern press and die design, coupled with recently developed tooling methods, give very great scope in the application of powder metallurgy to modern production needs. By means of data, diagrams, and other illustrations, this booklet provides designers and production engineers with much useful information on this subject.

Import Licensing Regulations

As from Wednesday last (November 5) the following changes in import licensing regulations took place:—

Individual import licences will no longer be required for the import of bandsaw strip of any size from any source.

Individual import licences will, in future, be required for tritium and any substances, mixtures, compounds and alloys containing tritium originating in and consigned from the Scheduled Territories.

Details are given in Notice to Importers No. 885, dated November 5, 1958, issued by the Import Licensing Branch of the Board of Trade.

An Appointment

News from the **Amber Chemical Company Ltd.** is to the effect that Mr. H. N. Wigan has resigned from the board of the company. Mr. J. Firminger, who joined the company at the end of 1957 and was appointed general manager, home sales, has now been appointed technical manager.

New Offices

At the Rogerstone rolling mills and extrusion plant of **Northern Aluminium Company Limited,** office accommodation has for several years ceded pride of place to the development of production facilities. A month or two ago, however, saw the completion there of a new office block that will allow the efficient centralization of a large proportion of those who look after the control and smooth running of this 3,000-man works. The modern building makes a striking addition to the site, and has several constructional features of interest.

The framework of the building is of precast reinforced-concrete stanchions, spaced at 8 ft. 4 in. intervals and connected by a perimeter beam at each floor level. There is also a central line of similar stanchions, cast *in situ* and spaced at 16 ft. 8 in. centres. Structural floors are of precast, pre-stressed units, giving an even under-surface without visible beams in the ceiling. This allows a completely free arrangement of internal partitions.

Aluminium glazing is the principal facing material, made up in 8 ft. 4 in. wide continuous vertical units. The elements that make these up are 4 ft. wide double-hung sash windows with frames of Noral 50S (B.S.1476:HE9) alloy, and reeded aluminium spandrels composed of special extruded sections, placed between each window sill and the head of the window below. The spandrels are of anodized Noral 33S alloy, and have a characteristic natural warm grey finish achieved without the use of dyes. Casings for the nibs of the columns (forming the mullions), and cover fillets at the junction of the windows, are also of aluminium.

At the ends of the front and rear elevations, broad vertical panels of buff-coloured brickwork are introduced, both to avoid too metallic an appearance in the building and to provide wind bracing. Flashing for the roof coping is of Noral 3S (B.S.1470:NS3) alloy.

Within the main frame of the building, the office accommodation is formed by means of movable, glazed aluminium partitions of patented type; the columns and trim of the partitions are of Noral 50S and B51S (B.S.s HE9 and HE30) alloys. Ceilings are of acoustic tiles, and most floors are of cork tile. In the entrance hall and the open stairway leading off it, textural contrast is achieved by a blending of marble wall lining, brick, and stone mosaic, while the floor is of Westmorland slate. The reception desk and fittings are of hardwood, with aluminium trim.

Aluminium (in the form of Noral 50S and B51S alloys) is also used for the construction of a cantilevered canopy over the main entrance, for framing the large sliding glass doors of the penthouse, for details such as push-plates on doors, kick-plates and switch-plates. Balustrades and external handrailing are of anodized 50S alloy, with castings of Noral 165A.

Anglo-American Agreement

It is announced by the **Solartron Electronic Group Ltd.** that they have concluded selling and manufacturing licensing agreements for the "Kintel" range of electronic products of the Cohu Electronics Inc., of San Diego, California, U.S.A., which covers the whole world, with the exception of Sweden and North and South America.

Enquiry from Iran

Tenders are invited by the Iranian State Railways for approximately 120 tons of copper wire and galvanized iron wire of 2 mm. and 4 mm. Tenders are to be submitted by December 22, 1958, and full details of these requirements may be obtained from the Bureau du Matériel des Chemins de Fer, Service des Adjudications et des Contrats, Tehran.

Forthcoming Meetings

November 10—Institute of Metals. Scottish Local Section. Institution of Engineers and Shipbuilders in Scotland, 39 Elmbank Crescent, Glasgow, C.2. "The Practical Application of Cathodic Protection in the Marine Field." J. K. H. Tait and R. J. Thubron. 6.30 p.m.

November 11—Institute of Metals. South Wales Local Section. Royal Institution, Swansea. "Geochemical Methods of Mineral Exploration." J. S. Webb. 7 p.m.

November 11—Incorporated Plant Engineers. Manchester Branch. Engineers' Club, Albert Square, Manchester. "Radio-Isotopes in Industry." W. G. Busbridge. 7.15 p.m.

November 12—Institution of Production Engineers. Wolverhampton Section. Stafford Technical College, Stafford. "Industrial Finishing Techniques and Practice." "Paints and Organic Coatings." J. J. Stordy and W. G. J. Appleton. 7.15 p.m.

November 12—Institution of Production Engineers. South Essex Section. Ilford Club, 21a Balfour Road, Ilford. "The Application of Radio-Active Isotopes in Industry." J. L. Putman. 7.30 p.m.

November 12 — Liverpool Metallurgical Society. (Joint Meeting with the Liverpool Branch of The Institute of Welding.) Picton Library, Liverpool. "The Gas Cutting of Metal Plates." L. C. Bannister. 7 p.m.

November 13 — Southampton Metallurgical Society. Small Physics Lecture Theatre, The University, Southampton. "Recent Developments in Magnesium Base Alloy." D. J. Whitehead. 7.15 p.m.

November 14—Society of Instrument Technology. Midland Section. Regent House, St. Philip's Place, Colmore Row, Birmingham, 3. "Transistors." S. S. Goldberg. 7 p.m.

November 14—Institution of Production Engineers. Ipswich and Colchester Section. (Joint Meeting with the Eastern Counties Branch of the Institute of Welding.) Golden Lion Hotel, Cornhill, Ipswich. "Joining Dissimilar Metals." A. A. Smith and J. G. Young. 7.30 p.m.

Metal Market News

WITH the exception of lead, which suffered a fairly sharp setback, values were better on the Metal Exchange last week, copper and tin being outstanding in their gains. The background of trading was disturbed, for Wall Street, although staging a recovery, was, nevertheless, somewhat uncertain in its movements and did not display that buoyant confidence which has been a characteristic of the American stock market for so many weeks. Nevertheless, sentiment in the United States is, on the whole, decidedly optimistic, and in this country, too, there is a tendency to feel that the decline in industrial activity will not go much further. Indeed, there are signs of some pick-up in steel, and in the building trade things are probably rather better than they were. On the Continent, conditions are not very wonderful, and in Germany demand is not what it was. Incidentally it may be mentioned that, according to one report, the U.K. consumption of copper in September was about 52,000 tons. The week opened in copper with news of a drop of 685 tons in L.M.E. stocks to 8,234 tons, and it is confidently predicted that this figure will shrink much further before a turn comes. Throughout the week the market was under the influence of hopes and fears about the various strikes in progress, although it must be admitted that the stoppage at the Inco plant has not yet reached the stage when there are definite hopes of an agreement being reached. Early in the week the price eased somewhat on rather better news from Kitwe, coupled with a report that the Board of Trade intended to release 10,000 tons of copper from their stockpile. Later in the week a more favourable account was given of the progress in the El Paso dispute talks, and finally, on Friday, came news that the men were going back to work.

On Friday, too, it became known that the European mineworkers on the Copperbelt were to vote on the question of a return to work, and there were hopes that the result would be favourable. But these hopes were dashed when it became known that the men had voted in overwhelming numbers against going back to work. By the time this news came through the afternoon Kerb market was over, so that no prices were registered, the general expectation, however, being that there would be a very firm opening on Monday, for it was felt that the strike might continue well into November. In view of the outlook, it seems very likely, as we write, that the United States prices will be raised again, with the producers coming up to 30 cents. Consumers in the U.K. are now buying very reluctantly, for they do not trust the price level, and probably the producers themselves are apprehensive that the inflated price may pave the way for substitutes for copper to gain ground. At midday on Friday there was a burst of strength in the second session of copper, and at the close the settlement price stood at £252. In the afternoon, however, values eased to £249 cash and £237 three months, at which level trading for the week came to an end. On balance there was a gain of £5 in cash but a loss of 5s. in three months, the backwardation being £12. The turnover without Kerb trading was over 11,000 tons.

Tin put up a good show without any special feature emerging, and after a turnover of about 650 tons cash closed £3 10s. 0d. up at £751, and three months £7 better at £750, so that the "back" closed in considerably. Lead was a poor market and lost £3 12s. 6d. for the current month and £2 5s. 0d. forward to close at £72 7s. 6d. and £73 10s. 0d. The turnover was 6,275 tons. For the first time since trading in metal futures began again, this metal stood below zinc, which, after sales of 7,100 tons, was quoted 25s. up for prompt at £74 5s. 0d., and 10s. better for forward at £72.

Birmingham

Conditions in the Midland non-ferrous industry have changed little during the past week. Orders are difficult to obtain and although unemployment is not as widespread as it is in some parts of the country, it is at its worst level for ten years. There is no doubt that the prosperity of the motor trade is responsible for preventing further deterioration. A downward trend in the volume of exports is a matter of serious concern to manufacturers and exporting merchants. Strong pleas for the reduction of purchase tax were made during a discussion on the trade situation at a meeting of the Birmingham Chamber of Commerce recently. One speaker blamed purchase tax for being, perhaps, the biggest contributor to the continuous demand for higher wages.

The dullness continues in nearly all branches of the iron and steel trade. Short time is the rule in many works, and consumers are continuing the process of drawing on stocks rather than place fresh business. Sheets are in good demand by the motor trade, and the plate mills are still well employed. Re-rolling mills, however, are short of work and supplies of semi-finished steel are more than sufficient for the needs of the mills. Prospects are a little brighter in the market for light iron castings, although employment is fairly high in most of the foundries in the Black Country. Active conditions continue in the works building rolling stock for home and overseas railways.

New York

Market news over the last week-end said that copper futures, after earlier easiness on news that the Phelps Dodge strike at El Paso refinery was over, firmed later on the report that the Rhodesian copper workers had decided to stay out. Meanwhile, copper continued tight. One leading producer source said he envisaged tight copper conditions till the end of the year, with supply easing in early 1959. Custom smelters with copper to sell reported sales satisfactory.

Lead and zinc were quiet. Lead sales for the week were placed at 4,921 tons. Tin was quiet and firm, reflecting the advance in the Far East. Buying was negligible.

Western Germany

Production of most non-ferrous metals in West Germany will probably be lower this year than in 1957, judging from statistics for the first three-quarters of this year, industry sources here report. Among the few exceptions was the production of copper, which still showed a steady upward trend.

Output of the main metals was as follows (in metric tons, the figures for the first three-quarters of this year being provisional): virgin aluminium, 105,359 (118,191 in the first three-quarters of 1957); electrolytic copper, 142,560 (136,740); crude zinc, 131,566 (137,424); foundry lead, 125,065 (130,565); pure tin, 1,508 (1,488).

The sources said the main reasons for this development were comparatively high stocks of the main metals carried over from last year, and the general slackening of industrial expansion which had caused a downward trend of metal production and consumption since 1956.

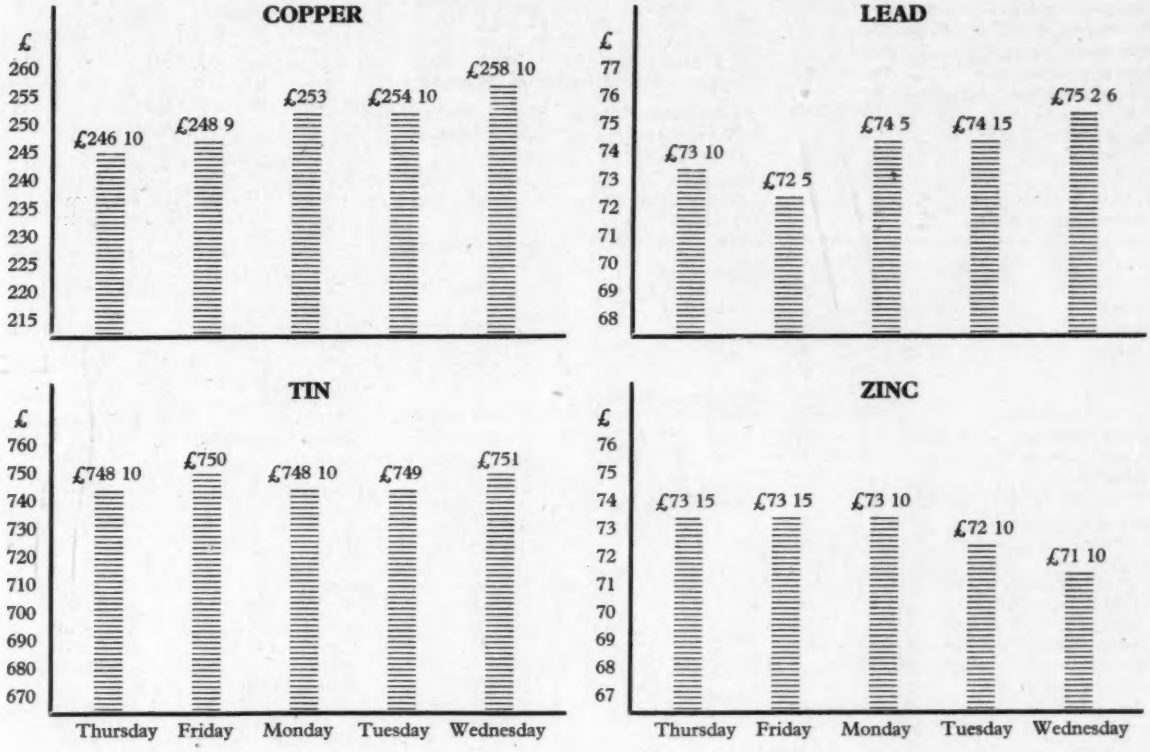
Italy

The Italian quicksilver industry is passing through a serious crisis, according to the General Confederation of Italian Industry. Current trade union agitation in the mines is probably aimed at total nationalization of the industry, the Confederation asserts. Trade unionists, on the other hand, claim that sit-down strikes at certain mines in the Monte Amiata region result from a breakdown in conciliation talks on wages.

The Government should abolish the manufacturing tax of 32,000 lire per flask imposed some years ago, the Confederation asserted. In the past, Italy had been one of the world's foremost producers and exporters of quicksilver.

METAL PRICE CHANGES

LONDON METAL EXCHANGE, Thursday 30 October 1958 to Wednesday 5 November 1958



OVERSEAS PRICES

Latest available quotations for non-ferrous metals with approximate sterling equivalents based on current exchange rates

	Belgium fr/kg ≏ £/ton	Canada c/lb ≏ £/ton	France fr/kg ≏ £/ton	Italy lire/kg ≏ £/ton	Switzerland fr/kg ≏ £/ton	United States c/lb ≏ £/ton
Aluminium		22.50 185 17 6	210 182 15	375 217 10		26.80 214 10
Antimony 99.0			195 169 12 6	430 249 10		29.00 232 0
Cadmium			1,500 1,305 0			145.00 1,160 0
Copper						
Crude						
Wire bars 99.9				470 272 12 6		
Electrolytic	33.75 246 15	28.25 233 7 6	295 256 12 6		3.00 250 17 6	29.00 232 0
Lead		11.25 93 0	115 100 0	184 106 15	.91 76 0	13.00 104 0
Magnesium						
Nickel		70.00 578 5	1,205 1,048 7 6	1,300 754 0	7.56 632 2 6	74.00 592 0
Tin	104.50 763 17 6		917 797 15	1,430 829 10	8.70 727 10	98.00 784 0
Zinc						
Prime western		11.00 90 17 6				11.00 88 0
High grade 99.95		11.60 95 17 6				
High grade 99.99		12.00 99 2 6				
Thermic			107.12 93 2 6			
Electrolytic			115.12 100 2 6	175 101 10	.92 77 0	12.25 98 0

NON-FERROUS METAL PRICES

(All prices quoted are those available at 2 p.m. 5/11/58)

PRIMARY METALS

		£	s.	d.
Aluminium Ingots	ton	180	0	0
Antimony 99·6%	„	197	0	0
Antimony Metal 99%	„	190	0	0
Antimony Oxide	„	180	0	0
Antimony Sulphide Lump	„	190	0	0
Antimony Sulphide Black Powder	„	205	0	0
Arsenic	„	400	0	0
Bismuth 99·95%	lb.		16	0
Cadmium 99·9%	„		9	6
Calcium	„	2	0	0
Cerium 99%	„	16	0	0
Chromium	„		6	11
Cobalt	„		16	0
Columbite	per unit		—	
Copper H.C. Electro	ton	258	10	0
Fire Refined 99·70%	„	257	0	0
Fire Refined 99·50%	„	256	0	0
Copper Sulphate	„	76	0	0
Germanium	grm.		—	
Gold	oz.	12	10	1½
Indium	„		10	0
Iridium	„	20	0	0
Lanthanum	grm.		15	0
Lead English	ton	75	2	6
Magnesium Ingots	lb.		2	5½
Notched Bar	„		2	10½
Powder Grade 4	„		6	3
Alloy Ingot, A8 or AZ91	„		2	8
Manganese Metal	ton	290	0	0
Mercury	flask	78	0	0
Molybdenum	lb.	1	10	0
Nickel	ton	600	0	0
F. Shot	lb.		5	5
F. Ingot	„		5	6
Osmium	oz.		nom.	
Osmiridium	„		nom.	
Palladium	„	5	15	0
Platinum	„	21	5	0
Rhodium	„	40	0	0
Ruthenium	„	15	0	0
Selenium	lb.		nom.	
Silicon 98%	ton		nom.	
Silver Spot Bars	oz.		6	6
Tellurium	lb.		15	0
Tin	ton	751	0	0
***Zinc**				
Electrolytic	ton		—	
Min 99·99%	„		—	
Virgin Min 98%	„	70	10	0
Dust 95/97%	„	104	0	0
Dust 98/99%	„	110	0	0
Granulated 99+%	„	95	10	0
Granulated 99·99+%	„	109	7	6

**Duty and Carriage to customers' works for buyers' account.*

INGOT METALS

Aluminium Alloy (Virgin)		£	s.	d.
B.S. 1490 L.M.5	ton	210	0	0
B.S. 1490 L.M.6	„	202	0	0
B.S. 1490 L.M.7	„	216	0	0
B.S. 1490 L.M.8	„	203	0	0
B.S. 1490 L.M.9	„	203	0	0
B.S. 1490 L.M.10	„	221	0	0
B.S. 1490 L.M.11	„	215	0	0
B.S. 1490 L.M.12	„	223	0	0
B.S. 1490 L.M.13	„	216	0	0
B.S. 1490 L.M.14	„	224	0	0
B.S. 1490 L.M.15	„	210	0	0
B.S. 1490 L.M.16	„	206	0	0
B.S. 1490 L.M.18	„	203	0	0
B.S. 1490 L.M.22	„	210	0	0

		£	s.	d.
†**Aluminium Alloys (Secondary)**				
B.S. 1490 L.M.1	ton	144	0	0
B.S. 1490 L.M.2	„	152	0	0
B.S. 1490 L.M.4	„	169	0	0
B.S. 1490 L.M.6	„	187	0	0

†Average selling prices for mid September

***Aluminium Bronze**				
BSS 1400 AB.1	ton	235	0	0
BSS 1400 AB.2	„		—	
***Brass**				
BSS 1400-B3 65/35	„	160	0	0
BSS 249	„		—	
BSS 1400-B6 85/15	„		—	
***Gunmetal**				
R.C.H. 3/4%	ton		—	
(85/5/5/5)	„	196	0	0
(86/7/5/2)	„	206	0	0
(88/10/2/1)	„	255	0	0
(88/10/2/½)	„	271	0	0
Manganese Bronze				
BSS 1400 HTB1	„	192	0	0
BSS 1400 HTB2	„	202	0	0
BSS 1400 HTB3	„		—	
Nickel Silver				
Casting Quality 12%	„		nom.	
„ „ 16%	„		nom.	
„ „ 18%	„		nom.	
***Phosphor Bronze**				
B.S. 1400 P.B.1 (A.I.D. released)	„	284	0	0
B.S. 1400 L.P.B.1	„	224	0	0
Phosphor Copper				
10%	„	257	0	0
15%	„	261	0	0

**Average prices for the last week-end.*

Phosphor Tin				
5%	ton		—	
Silicon Bronze				
BSS 1400-SB1	„		—	
Solder, soft, BSS 219				
Grade C Tinmans	„	354	3	0
Grade D Plumbers	„	286	9	0
Grade M	„	388	0	0
Solder, Brazing, BSS 1845				
Type 8 (Granulated)	lb.		—	
Type 9 „	„		—	
Zinc Alloys				
Mazak III	ton	102	12	6
Mazak V	„	106	12	6
Kayem	„	112	12	6
Kayem II	„	118	12	6
Sodium-Zinc	lb.		2	6

SEMI-FABRICATED PRODUCTS

Prices of all semi-fabricated products vary according to dimensions and quantities. The following are the basis prices for certain specific products.

Aluminium				£	s.	d.
Sheet	10	S.W.G.	lb.		2	8½
Sheet	18	S.W.G.	„		2	10½
Sheet	24	S.W.G.	„		3	1½
Strip	10	S.W.G.	„		2	8½
Strip	18	S.W.G.	„		2	9½
Strip	24	S.W.G.	„		2	11
Circles	22	S.W.G.	„		3	2½
Circles	18	S.W.G.	„		3	1½
Circles	12	S.W.G.	„		3	0½
Plate as rolled			„		2	8
Sections			„		3	2
Wire 10 S.W.G.			„		2	11½
Tubes 1 in. o.d. 16 S.W.G.			„		4	1

Aluminium Alloys				£	s.	d.
BS1470. HS10W.			lb.			
Sheet	10	S.W.G.	„		3	1
Sheet	18	S.W.G.	„		3	3½
Sheet	24	S.W.G.	„		3	11
Strip	10	S.W.G.	„		3	1
Strip	18	S.W.G.	„		3	2½
Strip	24	S.W.G.	„		3	10½
BS1477. HP30M. Plate as rolled			„		2	11
BS1470. HC15WP.						
Sheet	10	S.W.G.	„		3	9½
Sheet	18	S.W.G.	„		4	2
Sheet	24	S.W.G.	„		5	0½
Strip	10	S.W.G.	„		3	10½
Strip	18	S.W.G.	„		4	2
Strip	24	S.W.G.	„		4	9½
BS1477. HPC15WP. Plate heat treated			„		3	6½
BS1475. HG10W. Wire	10	S.W.G.	„		3	10½
BS1471. HT10WP. Tubes 1 in. o.d. 16 S.W.G.			„		5	0½
BS1476. HE10WP. Sections			„		3	1½
Beryllium Copper						
Strip			„	1	4	11
Rod			„	1	1	6
Wire			„	1	4	9
Brass Tubes			„		2	0
Brazed Tubes			„		—	
Drawn Strip Sections			„		—	
Sheet			ton		—	
Strip			„	263	15	0
Extruded Bar			lb.		2	1⅜
Extruded Bar (Pure Metal Basis)			„		—	
Condenser Plate (Yellow Metal)			ton	198	0	0
Condenser Plate (Naval Brass)			„	210	0	0
Wire			lb.		2	9⅜
Copper Tubes			lb.		2	5⅞
Sheet			ton	289	0	0
Strip			„	289	0	0
Plain Plates			„		—	
Locomotive Rods			„		—	
H.C. Wire			„	303	5	0
Cupro Nickel Tubes 70/30			lb.		3	8½
Lead Pipes (London)			ton	112	10	0
Sheets (London)			„	110	5	0
Tellurium Lead			„	£6 extra		
Nickel Silver Sheet and Strip 7%			lb.		3	8¾
Wire 10%			„		4	3½
Phosphor Bronze Wire			„		4	3½
Titanium (1,000 lb. lots)						
Billet over 4″ dia.-18″ dia.			lb.	63/-		64/-
Rod 4″ dia.-·250″ dia.			„	75/-		112/-
Wire under ·250″ dia.-·036″ dia.			„	146/-		222/-
Sheet 8′ × 2′ × ·250″-·010″ thick			„	88/-		157/-
Strip ·048″-·003″ thick			„	100/-		350/-
Tube (representative gauge)			„			300/-
Extrusions			„			120/-
Zinc Sheets, English destinations			ton	107	5	0
Strip			„		nom.	

Scrap Metal Prices

Merchants' average buying prices delivered, per ton, 4/11/58.

	£
Aluminium	
New Cuttings	140
Old Rolled	120
Segregated Turnings	90
Brass	
Cuttings	144
Rod Ends	141
Heavy Yellow	121
Light	116
Rolled	133
Collected Scrap	119
Turnings	133
Copper	
Wire	204
Firebox, cut up	200
Heavy	195
Light	190
Cuttings	203
Turnings	183
Braziery	161
Gunmetal	
Gear Wheels	188
Admiralty	188
Commercial	163
Turnings	158
Lead	
Scrap	66
Nickel	
Cuttings	—
Anodes	500
Phosphor Bronze	
Scrap	163
Turnings	158
Zinc	
Remelted	59
Cuttings	45
Old Zinc	34

The latest available scrap prices quoted on foreign markets are as follow. (The figures in brackets give the English equivalents in £1 per ton):—

West Germany (D-marks per 100 kilos):		
Used copper wire	(£195.17.6)	225
Heavy copper	(£191.10.0)	220
Light copper	(£161.0.0)	185
Heavy brass	(£119.2.6)	137
Light brass	(£91.7.6)	105
Soft lead scrap	(£61.0.0)	70
Zinc scrap	(£34.17.6)	40
Used aluminium unsorted	(£87.0.0)	100
France (francs per kilo):		
Copper	(£213.2.6)	245
Heavy copper	(£213.2.6)	245
Light brass	(£143.10.0)	165
Zinc castings	(£61.0.0)	70
Lead	(£86.2.6)	99
Tin	—	
Aluminium	(£117.10.0)	135
Italy (lire per kilo):		
Aluminium soft sheet clippings (new)	(£194.7.6)	335
Aluminium copper alloy	(£124.15.0)	215
Lead, soft, first quality	(£87.0.0)	150
Lead, battery plates	(£51.0.0)	88
Copper, first grade	(£214.12.6)	370
Copper, second grade	(£203.0.0)	350
Bronze, first quality machinery	(£211.15.0)	365
Bronze, commercial gunmetal	(£182.15.0)	315
Brass, heavy	(£150.17.6)	260
Brass, light	(£139.5.0)	240
Brass, bar turnings	(£145.0.0)	250
New zinc sheet clippings	(£58.0.0)	100
Old zinc	(£43.10.0)	75

Financial News

W. and J. Lawley Ltd.

Dividend 25 per cent on Ordinary, year ended July 31, 1958 (same). Group profit £87,426 (£92,534), tax £47,997 (£54,321), net profit £39,429 (£38,213), plus tax over-provided £1,018 (£822). Dividend £17,250 (same), general reserve £17,500 (same), forward £57,477 (£51,780).

James H. Dennis and Co. Ltd.

No Ordinary dividend for year to July 31, 1958 (13½ per cent) and no Preference dividend—now one year in arrear. Group loss after tax £27,712 (parent's profit £25,813). To U.K tax, after adjustment, £7,835 (£25,218). Transfer from stock reserves £35,000 (£15,000). Results include 10 months' trading of new subsidiary — Knowsley Cast Metal — net before tax £33,320. Forward, £23,810 (£51,633).

Brett's Stamping Co.

Dividend of 15 per cent for the year ended July 31, 1958, on an Ordinary capital increased to £200,000 after a one-for-four scrip issue. Net profit declined from £41,067 to £23,434, after tax of £35,000 (£53,000). With £1,000 tax adjustments credited, the balance forward is £51,719 (£45,225).

New Companies

The particulars of companies recently registered are quoted from the daily register compiled by Jordan and Sons Limited, Company Registration Agents, Chancery Lane, W.C.2.

G. L. Willan (Castings) Limited (611484), Sussex Street, Sheffield, 4. Registered September 18, 1958. Nominal capital, £35,000 in £1 shares. Directors: Geoffrey L. Willan and James H. G. Willan.

Chelmsford Metals Limited (611516), 52 New London Road, Chelmsford. Registered September 19, 1958. Nominal capital, £10,000 in £1 shares (5,000 "A" and 5,000 "B"). Directors: Leonard P. T. Jermy and Hans J. Cohn.

Elthorne Metals Limited (611578), 18 Elthorne Road, N.19. Registered September 22, 1958. Nominal capital, £1,000 in £1 shares. Permanent directors: George F. Portway, Herbert G. Payne and Wm. G. Payne.

Precise Electro-Plating Works Limited (611593), Dyer Road, Southampton. Registered September 22, 1958. Nominal capital, £1,000 in £1 shares. Permanent directors: Leonard J. Samways and Harry R. V. Wilson.

Trade Publications

Copper in Building.—Imperial Chemical Industries Limited, Imperial Chemical House, Millbank, London, S.W.1.

A new eight-page booklet is devoted to the use of I.C.I. copper sheet and strip, which are among the Metals Division's specialized building products. Details relating to the adaptability of copper in building are given, together with other data, and some photographs of buildings where copper has been used in various forms.

A Pictorial Survey.—Tom Martin and Co. (Blackburn) Ltd., Audley Metal Works, Dickens Street, Blackburn, Lancs.

This enterprising firm has produced within the range of sixteen pages a pictorial demonstration of the various sections which form their main plant in Blackburn. After introducing the personalities of the company, photographs are given of the processing plant, the baling of copper wire, grading, cutting and shearing, and other activities. A very interesting and useful illustration of the work carried out by the company.

Wet Dedusting.—Dallow Lambert and Company Ltd., Thurmaston, Leicester.

A useful four-page leaflet, in colour, is issued by this company providing much information relating to its wet deduster series MG. In addition to statistics and diagrams, the fourth page of the leaflet is devoted to illustrations of some of the many and varied applications of the company's dedusters which are being successfully used.

Hydrovane Compressors.—Whittaker Hall and Co. (1929) Ltd., Black Lane Engineering Works, Radcliffe, Manchester.

An illustrated folder provides much useful information relating to this company's Hydrovane oil flooded rotary compressors. The information is conveyed in the form of a series of questions and answers.

Electric Furnaces.—A.E.W. Ltd., Imperial Works, High Street, Edgware, Middx.

This company has recently issued an illustrated leaflet describing their electric furnaces for laboratory and workshop use.

Rapid Metal Drying.—Imperial Chemical Industries Limited, Imperial Chemical House, Millbank, London, S.W.1.

An eight-page booklet describes, and illustrates "Trisec," which, as a special additive to trichloroethylene, removes water from articles. It is used in suitably modified I.C.I. metal degreasing plants. This process is said to be ideal for the rapid drying of metal after aqueous processes such as electroplating, phosphating, chromating, electropolishing, and similar processes.

Carboy Handling Equipment. — Powell and Company, Burry Port, Carms., South Wales.

A four-page leaflet dealing with "Safe-Way" carboy handling equipment of various types. Full details are given, together with several illustrations, and includes details of a combined lifter, transporter and tilter.

THE STOCK EXCHANGE

Markets Continued Active And Strong. British Aluminium Registered Outstanding Advance

ISSUED CAPITAL •	AMOUNT OF SHARE	NAME OF COMPANY	MIDDLE PRICE 4 NOVEMBER	+RISE —FALL	DIV. FOR LAST FIN. YEAR	DIV. FOR PREV. YEAR	DIV. YIELD	1958 HIGH	1958 LOW	1957 HIGH	1957 LOW
£	£				Per cent	Per cent					
4,435,792	1	Amalgamated Metal Corporation ...	23/3		9	10	7 14 9	23/3	17/6	28/3	18/–
400,000	2/–	Anti-Attrition Metal	1/7½	+1¼d.	4	8½	4 18 6	1/7½	1/3	2/6	1/6
33,639,483	Stk. (£1)	Associated Electrical Industries ...	55/6	+2/–	15	15	5 8 0	55/6	46/6	72/3	47/9
1,590,000	1	Birfield Industries	59/–xd	—3d.	15	15	5 1 9	62/4½	46/3	70/–	48/9
3,196,667	1	Birmid Industries	69/3	—1/9	17½	17½	5 1 0	77/–	55/3	80/6	55/9
5,630,344	Stk. (£1)	Birmingham Small Arms	37/3	+3/3	10	8	5 7 3	37/3	23/9	33/–	21/9
203,150	Stk. (£1)	Ditto Cum. A. Pref. 5%	16/1½		5	5	6 4 0	16/1½	14/7½	16/–	15/–
350,580	Stk. (£1)	Ditto Cum. B. Pref. 6%	17/1½		6	6	7 0 3	17/4½	16/6	19/–	16/6
500,000	1	Bolton (Thos.) & Sons	26/3		12½	12½	9 10 6	28/9	24/–	30/3	28/9
300,000	1	Ditto Pref. 5%	15/–		5	5	6 13 3	16/–	15/–	16/9	14/3
160,000	1	Booth (James) & Co. Cum. Pref. 7%	20/–		7	7	7 0 0	19/4½	19/–	22/3	18/9
9,000,000	Stk. (£1)	British Aluminium Co.	56/6	+5/6	12	12	4 5 0	56/6	36/6	72/–	38/3
1,500,000	Stk. (£1)	Ditto Pref. 6%	19/6	+3d.	6	6	6 3 0	20/–	18/4½	21/6	18/–
15,000,000	Stk. (£1)	British Insulated Callender's Cables	48/9	—3d.	12½	12½	5 2 6	49/–	38/9	55/–	40/–
17,047,166	Stk. (£1)	British Oxygen Co. Ltd., Ord. ...	44/–	+6d.	10	10	4 11 0	44/3	29/–	39/–	29/6
600,000	Stk. (5/–)	Canning (W.) & Co.	24/3xd	—1½d.	25+	*2½C	25	5 3 0	24/6	19/7½	24/6	19/3
60,484	1/–	Carr (Chas.)	1/7½		25	25	10 15 6X	2/3	1/4½	3/6	2/1½
150,000	2/–	Case (Alfred) & Co. Ltd.	5/3	+1½d.	25	25	9 10 6	5/3	4/–	4/6	4/–
555,000	1	Clifford (Chas.) Ltd.	20/9	+3d.	10	10	9 12 9	20/9	16/–	20/6	15/9
45,000	1	Ditto Cum. Pref. 6%	15/6		6	6	7 14 9	15/10½	15/7½	17/6	16/–
250,000	2/–	Coley Metals	3/–	—3d.	20	25	13 6 9	4/6	2/6	5/7½	3/9
8,730,596	1	Cons. Zinc Corp.†	56/–	+6d.	18¾	22½	6 13 9	57/9	41/–	92/6	49/–
1,136,233	1	Davy & United	75/6		20	15	5 6 0	75/6	45/9	60/6	42/6
2,750,000	5/–	Delta Metal	23/7½	+10½d.	30	*17½	6 6 3	23/9	17/7½	28/6	19/–
4,160,000	Stk. (£1)	Enfield Rolling Mills Ltd.	36/–		12½	15B	6 19 0	36/6	22/9	38/6	25/–
750,000	1	Evered & Co.	27/6		15Z	15	7 5 6	28/3	26/–	52/9	42/–
18,000,000	Stk. (£1)	General Electric Co.	37/9	+3d.	10	12½	5 6 0	39/6	29/6	59/–	38/–
1,500,000	Stk. (10/–)	General Refractories Ltd.	36/3		20	17½	5 10 3	37/6	27/3	37/–	26/9
401,240	1	Gibbons (Dudley) Ltd.	66/3		15	15	4 10 6	66/3	61/–	71/–	53/–
750,000	5/–	Glacier Metal Co. Ltd.	7/1½	—4½d.	11½	11½	8 1 6	7/9	5/6	8/1½	5/10½
1,750,000	5/–	Glynwed Tubes	17/4½	+4½d.	20	20	5 15 0	17/7½	12/10½	18/–	12/6
5,421,049	10/–	Goodlass Wall & Lead Industries ...	27/–	+1/3	13‖	18Z	4 16 3	27/–	19/3	37/3	28/9
342,195	1	Greenwood & Batley	52/6		20	17½	7 12 6	52/6	45/–	50/–	46/–
396,000	5/–	Harrison (B'ham) Ord.	15/9	+3d.	*15	*15	4 15 3	15/9	11/6	16/9	12/4½
150,000	1	Ditto Cum. Pref. 7%	19/9	+9d.	7	7	7 1 9	19/9	18/9	22/3	18/7½
1,075,167	5/–	Heenan Group	9/4½	—1½d.	10	20‡	5 6 9	9/7½	6/9	10/4½	6/9
236,953,260	Stk. (£1)	Imperial Chemical Industries ...	35/7½	+1/1½	12Z	10	4 9 9	35/7½	27/7½	46/6	36/3
33,708,769	Stk. (£1)	Ditto Cum. Pref. 5%	16/7½	+1½d.	5	5	6 0 3	17/1½	16/–	18/6	15/6
14,584,025	**	International Nickel	159	—1	$3.75	$3.75	4 4 6	168½	132¾	222	130
430,000	5/–	Jenks (E. P.), Ltd.	8/9		27½♦	27½	7 17 3	8/9	6/9	18/10½	15/1½
300,000	1	Johnson, Matthey & Co. Cum. Pref. 5%	16/3		5	5	6 3 0	16/9	15/–	17/–	14/6
3,987,435	1	Ditto Ord.	42/3	+9d.	10	10	4 14 9	45/3	36/6	58/9	40/–
600,000	10/–	Keith, Blackman	23/9	+1/3	17½	15	7 7 6	23/9	15/–	21/9	15/–
160,000	4/–	London Aluminium	5/–	+10½d	10	10	8 0 0	5/–	3/–	6/9	3/6
2,400,000	1	London Elec. Wire & Smith's Ord. ...	63/3	+1/9	12½	12½	3 14 0	64/–	39/9	54/6	41/–
400,000	1	Ditto Pref.	23/6	—3d.	7½	7½	6 7 9	23/9	22/3	25/3	21/9
765,012	1	McKechnie Brothers Ord.	42/6		15	15	7 1 3	42/6	32/–	48/9	37/6
1,530,024	1	Ditto A Ord.	42/6		15	15	7 1 3	42/6	30/–	47/6	36/–
1,108,268	5/–	Manganese Bronze & Brass	13/3	+3d.	20	27½‡	7 11 0	13/3	8/9	21/10½	7/6
50,628	6/–	Ditto (7½% N.C. Pref.)	6/–		7½	7½	7 10 0	6/3	5/9	6/6	5/–
13,098,855	Stk. (£1)	Metal Box	62/–	+2/6	11	11	3 11 0	62/3	41/9	59/–	40/3
415,760	Stk. (2/–)	Metal Traders	7/10½	+1½d.	50	50	12 14 0	8/9	6/3	8/–	6/3
160,000	1	Mint (The) Birmingham	20/–		10	10	10 0 0	22/9	19/–	25/–	21/6
80,000	5	Ditto Pref. 6%	70/6	-	6	6	8 10 3	83/6	70/6	90/6	83/6
3,705,670	Stk. (£1)	Morgan Crucible A	41/6	+6d.	10	10	4 16 6	41/6	34/–	54/–	35/–
1,000,000	Stk. (£1)	Ditto 5½% Cum. 1st Pref. ...	17/7½	—1½d.	5½	5½	6 4 6	17/9	17/–	19/3	16/–
2,200,000	Stk (£1)	Murex	53/9		17½	20	6 10 3	58/9	47/9	79/9	57/–
468,000	5/–	Ratcliffs (Great Bridge)	10/10½xd		10	10	4 12 0	11/–	6/10½	8/–	6/10½
234,960	10/–	Sanderson Bros. & Newbould ...	26/–	+9d.	20	27½D	7 13 9	27/–	24/6	41/–	24/9
1,365,000	Stk. (5/–)	Serck	16/4½xd	+9d.	15	17½Z	4 11 9	16/10½	11/–	18/10½	11/6
6,698,586	Stk. (£1)	Stone-Platt Industries	41/9	+3/–	15	12½	7 3 9	41/9	22/6	33/4½	22/7½
2,928,963	Stk. (£1)	Ditto 5½% Cum. Pref.	15/9	+3d.	5½	5½	6 19 9	16/–	12/7½	14/–	12/9
14,494,862	Stk. (£1)	Tube Investments Ord.	74/3	+2/9	17½	15	4 14 3	74/3	48/4½	70/9	50/6
41,000,000	Stk. (£1)	Vickers	33/–	—3d.	10	10	6 1 3	34/–	28/9	46/–	29/–
750,000	Stk. (£1)	Ditto Pref. 5%	15/–		5	5	6 13 3	15/6	14/3	18/–	14/–
6,863,807	Stk. (£1)	Ditto Pref. 5% tax free	22/–		*5	*5	7 0 3A	23/–	21/3	24/9	20/7½
2,200,000	1	Ward (Thos. W.), Ord.	87/–		20	15	4 12 0	87/–	70/9	83/–	64/–
2,666,034	Stk. (£1)	Westinghouse Brake	41/9	+3d.	10	18P	4 15 9	42/9	32/6	85/–	29/1½
225,000	2/–	Wolverhampton Die-Casting ...	10/–	+3d.	30	25	6 0 0	10/–	7/1½	10/1½	7/–
591,000	5/–	Wolverhampton Metal	21/3		27½	27½	6 9 3	22/9	14/9	22/3	14/9
78,465	2/6	Wright, Bindley & Gell	4/6		20	17½E	11 2 3	4/10½	3/3	3/9	2/7½
124,140	1	Ditto Cum. Pref. 6%	13/–	+3d.	6	6	9 4 6	13/–	11/3	12/6	11/3
150,000	1/–	Zinc Alloy Rust Proof	2/10½		27	40D	9 7 9	3/1½	2/7½	5/–	2/9

*Dividend paid free of Income Tax. †Incorporating Zinc Corpn. & Imperial Smelting. **Shares of no Par Value. ‡ and 100% Capitalized issue. • The figures given relate to the issue quoted in the third column. A Calculated on £7 14 6 gross. Y Calculated on 11½% dividend. ‖Adjusted to allow for capitalization issue. E for 15 months. P and 100% capitalized issue, also "rights" issue of 2 new shares at 35/– per share for £3 stock held. D and 50% capitalized issue. Z and 50% capitalized issue. B equivalent to 12½% on existing Ordinary Capital after 100% capitalized issue. ♦ And 100% capitalized issue. X Calculated on 17½%. C Paid out of Capital Profits.